The effect of globalization on wage inequality – an application to the European Union

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Vita

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Abstract

This dissertation seeks to link the concepts of globalization and wage inequality, while comparing the different realities of developed and developing countries where this issue is concerned, and it includes a special focus, in the empirical portion, on the European Union. The goals are, first, to review the available theoretical and empirical literature, and then to test the foremost theoretical mechanisms by building and testing a panel data model on two samples of European Union countries (EU), one taking the place of the North and the other taking the place of the South, as they are defined in the mechanisms under scrutiny.

We found that trade has the effect of enhancing inequality in the "North" countries of our EU sample (confirming the Hecksher-Ohlin-Samuelson mechanism), though we could not significantly conclude on its effect in the "South". Foreign Direct Investment (FDI) Inflows have the effect of diminishing inequality in the "North", while FDI outflows have the same effect in the "South". These results are not predicted in Feenstra-Hanson theory. We also tested the effect of technology on inequality through two variables and, while we found mixed evidence for how the share of High Tech Exports affects inequality (we found both positive and negative coefficients for the "North" sample, the variable was not significant for the "South" sample), Gross Expenditure on Research and Development was, when significant, always positive for the "North" sample. By testing with a composite globalization index, we conclude that trade is dominant over FDI when it comes to which economic flow affects inequality with more force. Moreover, when we tested for the non-economic aspects of globalization, we found that both political and social aspects of it cause wage inequality to increase.

***Keywords*:** wage inequality; globalization; developing countries; Europe; panel data.

***JEL codes*:** C23; F15; F63; O15.

Resumo

Com esta dissertação, pretendemos explorar a relação entre a globalização e a desigualdade salarial, com um enfoque, na parte empírica, na União Europeia. Começámos por rever as principais teorias existentes sobre este tema, os principais mecanismos através dos quais a globalização afeta a desigualdade salarial dentro dos países, especificamente o papel do Comércio Internacional, do Investimento Direto Estrangeiro e da Tecnologia. Em seguida, revimos a literatura empírica sobre este assunto, tentando perceber se as teorias são confirmadas ou não pelos estudos já efetuados.

A nossa secção empírica consiste no estudo da União Europeia, dividida em dois grupos, fazendo o papel do "Norte" e "Sul" em que se baseiam as teorias que estudámos.

Concluímos que o comércio internacional aumenta a desigualdade no países do "Norte" da nossa amostra (confirmando a teoria de Hecksher-Ohlin-Samuelson), sendo que não conseguimos concluir sobre o seu efeito no "Sul". Os *inflows* de Investimento Direto Estrangeiro (IDE) fazem com que a desigualdade diminua no "Norte", enquanto os *outflows* de IDE têm o mesmo efeito no "Sul". Estes resultados não estão previstos na teoria de Feenstra-Hanson. Testámos o efeito da tecnologia na desigualdade, utilizando duas variáveis. Encontrámos resultados mistos para a primeira, a Percentagem de Exportações de Alta Tecnologia sobre o PIB (só sendo significativa para o "Norte", encontrámos tanto coeficientes positivos como negativos), mas o efeito da Despesa em Investigação em Desenvolvimento tem, consistentemente, um coeficiente positivo para a amostra "Norte". Testando o efeito de índice composto de globalização, concluímos que, no que toca aos fluxos económicos da globalização, o comércio tem um efeito mais pronunciado do que o IDE. Finalmente, quando testámos os aspetos não económicos da globalização, concluímos que, tanto os aspetos sociais, como os políticos, contribuem para o aumento da desigualdade.

***Palavras-chave*:** desigualdade salarial; globalização; países em desenvolvimento; Europa; dados em painel.

***Códigos JEL*:** C23; F15; F63; O15.

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List of Abbreviations

EU – European Union

FDI – Foreign Direct Investment

FH – Feenstra-Hanson theorem

GERD – Gross Expenditure on Research and Development

GDP – Gross Domestic Product

HOS – Hecksher-Ohlin-Samuelson theorem

HTE – Percentage of High Tech Exports over Gross Domestic Product

OECD – Organization for Economic Co-operation and Development

SBTC – Skill-Biased Technological Change

UNCTAD – United Nations Conference on Trade and Development

UNIDO – United Nations Industrial Development Organization

WDB – World Bank databank

1. Introduction

The now well-established, rather comprehensive, concept of globalization is arguably the best word to characterize cross-border integration in International Economics literature. The growing interconnectedness of economies all over the world, especially in terms of trade and investment, but also in terms of social and political dimensions, has an impact on the lives of nearly every person.

Therefore, it is natural that "[t]he pros and cons of globalization are vividly debated, and the labor market consequences are among the most persistent concerns." (Andersen and Sørensen, 2011; p. 595). In a world philosophy that purports to be global, it is hardly acceptable for some layers of the population not to be included as beneficiaries.

Globalization can be measured and defined in a myriad of different ways, from rising trade openness and higher levels of foreign direct investment flows to indices covering other economic, political and social dimensions. Examples of the latter include the Maastricht Globalization Index (MGI), Economic Freedom of the World Project (EFW), the Kearney Globalization Index (KGI) and the KOF Index.

Meanwhile, wage differences within a country are a crucial determinant of overall income equality. The wage gap between skilled and unskilled workers, in particular, is widely used in economic literature for assessing inequality. Several proxies can be used to assess this variable. Some examples are the wage gap between skilled and unskilled workers, the proportion of low-wage earners, the high-low decile or quartile ratios or indices of wage dispersion like the Theil index.

Given that "[t]here has been an upsurge in income and wage inequalities" in "advanced countries since the late 1970s" (Chusseau *et al.*, 2008; p. 411), there is a natural interest in studying these two phenomena and in trying to determine whether the two are connected. It is this relationship we intend to study in this work.

Theoretical economic literature has indeed been concerned with this relation for quite some time. Given the complex nature of globalization and of the mechanisms it sets off, however, there is not just one straightforward answer to this general question of how it affects inequality. The aspects of globalization are varied and the ways through which they work even more so. Therefore, there are several different mechanisms linking

different characteristics of our ever-more-open economic reality to the income inequality that is felt throughout the world.

One reference framework for this study is the Heckscher-Ohlin-Samuelson theorem, which states that increasing trade between developed and developing countries causes wage inequality to increase in developed countries and to decrease in developing countries. Another important theoretical framework is the Feenstra-Hanson theorem which focuses on Foreign Direct Investment (FDI), another characteristic of a global economy, and that concludes that FDI inflows from developed to developing countries cause increases in wage inequality in both sets of countries. Several other mechanisms operate within the economic dimension and in other dimensions of globalization to affect inequality.

One of the goals of this dissertation is to review the available literature on this subject – theoretical and empirical – and to assess whether the two are concordant: are the mechanisms predicted in economic theory truly observed to be in effect when applied to real economies and situations? Moreover, we intend to contribute with an empirical analysis to the study of this phenomenon in the context of the European Union (EU) and to spark a debate as to the differences in the effect of globalization on two sets of countries, since some of the mechanisms predict different results in developed and developing countries.

Therefore, Chapter 2 of this dissertation will focus on literature review, both theoretical and empirical. The theoretical section will specify the concepts, as well as describe the theoretical mechanisms linking globalization and inequality (and other mechanisms that are considered relevant to inequality, even if they are only indirectly attributable to globalization). The empirical section seeks to compile previous studies and to sum up their conclusions, regarding the validation of the mechanisms in question. Chapter 3 will describe the methodology of the empirical portion of this dissertation, detailing the model we are going to use, dependent and independent variables, sources of data, as well as the temporal and spatial scope of this study. Chapter 4 will present the results reached in the empirical study, starting with a descriptive analysis of inequality in these countries, then moving on to test each mechanism separately. Chapter 5 presents the concluding remarks.

2. Literature Review

2.1 The concepts

The main concepts involved in this study are those of Globalization and Wage Inequality. While, for the former, we expect to capture its broad definition, regarding the latter, we want specifically to focus on wage dispersion measures (and not on those related to wealth or disposable income).

2.1.1 Globalization

Generally speaking, and as explained by Krugman *et al.* (2011), what we think of as globalization today started with the growth of international trade which followed the Industrial Revolution, in the 19th century. This interconnectedness was severely hampered by the two World Wars which occurred in the 20th century and it is only after the Second World War ended in 1945 that what economists call the "second wave of globalization", which we are still in, began. It is this era of globalization that has been studied the most by economists and it is also the one we are concerned with here.

Globalization is not an easily-defined concept, as it includes economic, social and political aspects, all of which are crucial and have impacts on wage determination.

The political dimension is well-illustrated by institutions like the United Nations and the European Union (EU), examples of a world increasingly interested in working and finding solutions together. For instance, in the context of the Eurozone, member-states cannot make monetary policy decisions individually.

The social components include personal contact between people of different countries and cultural proximity, a reality which is ever more present, for example, in the everyday life of millions of internet users around the world, at negligible costs. This leads to the fact that millions of people around the world consume the same entertainment products and thereby end up sharing some of their cultural references with each other, even with those who are thousands of kilometers away.

Economic globalization will evidently be the facet this work will be most concerned with. It is usually connected with market liberalization, *i.e.*, the process of removal of

trade barriers and other "government-imposed restrictions on movements between countries in order to create an open and borderless world economy" (Zhou *et al.,* 2011; p. 2) and has as a main consequence an increased trade of goods and services across national borders, as well as of higher international capital flows, including Foreign Direct Investment (FDI), which can lead to a fragmentation of the value chain, now spread around a variety of countries.

In this dissertation, we will focus mainly on trade, FDI and technological status, as these are the facets of economic globalization mainly focused on by the most relevant and widely-discussed mechanisms, and because they are of easier measurement and the ones for which there is larger data availability.

However, there also exist aggregate measures of globalization, such as the already-mentioned KOF Index of Globalization, which measures, through its composite nature, the social and political aspects of globalization as well as the economic ones (Dreher and Gaston, 2008). We will use these measures to discuss the overall impacts of globalization later on.

2.1.2 Wage inequality

As is known, not all workers are paid the same. The difference in salary between workers with different skills is generally referred to as the skill premium, defined, therefore, as "the wage gap between skilled and unskilled workers" (Goldberg and Pavnick, 2007; p. 52). Several other measures can be used to assess wage inequality (*e.g.*, the proportion of low-wage earners, the high-low decile or quartile ratios or the Gini coefficient on wages).

Skilled and Unskilled Workers

To clarify on the operationalization of this concept, it is useful to define how we categorize a worker as skilled or unskilled. Empirically, a skilled worker is generally defined as a worker with higher (or tertiary) education, while an unskilled worker is someone with no more than secondary education. Cho and Díaz (2013), for example, analyze "three skill levels (high: corresponding to workers with higher or tertiary

education, medium: for workers with secondary education, and low: for workers with primary education)" (Cho and Díaz, 2013; p. 603). Similar classifications are found in many other sources, for instance, in the EU KLEMS database.

2.2 The mechanisms linking globalization and wage inequality

In order to identify the several theoretical mechanisms through which globalization affects wage inequality, we will review the most well-known and established models of trade.

2.2.1 Early models

The Ricardian Model of Comparative Advantages is the first and simplest international trade model in the economic literature. As described in Krugman *et al*. (2011), this model takes into account a situation in which two countries and only one factor of production, labor, exist. Each country will specialize in the production of the good in which it has a comparative advantage (*i.e.*, the one for which production involves lowest opportunity cost), engaging then in international trade with the other country so it can obtain the good in which the other country has a comparative advantage (and in the production of which it has, in turn, specialized). In this very simple model, in which labor is the only factor, a worker's wage is exactly the same as the relative price of the good it produces and exports (real exchange rate as defined by the ratio between exports' and imports' price) multiplied by the quantity of the good they have produced. The model does not elaborate on the distribution of this income, since it assumes all workers within each of the countries earn the same for each unit produced, their wage being dependent only, therefore, on the amount of goods they produce.

Another theory, the Specific Factor model, builds upon the Ricardian model to explain within-country inequality and the uneven distribution of the benefits of trade. According to this model, and as related once again by to Krugman *et al.* (2011), distribution of income is deeply affected by international trade for two main reasons: (i) in the short-run, the transfer of resources from one industry to the other involves costs (*i.e.*, transfer of resources required for the specialization of the country's production in the good it has a comparative advantage in, according to the Ricardian model) and (ii) in the long-run,

the owners of the factors specifically linked to the good in which the country will specialize will benefit from trade while those who own the factors used in producing the good in which the foreign country will specialize in will be at a disadvantage; indeed, the country specializes in a good that does not require their factors and they will not be compensated for owning them. The model also considers general-purpose factors, which are interchangeably used in the production of any good: the owners of these factors could either win or lose, depending on whether more or less of their factor is necessary in the new production paradigm. It is considered that, overall, the gains of one group will compensate the losses of the others (or, if owners of general-purpose factors also win, the gains of those two groups are expected to compensate the losses of the other) so that overall any country participating in international trade is still benefiting from it. The question of, within each country, one group being at a disadvantage is not considered relevant because overall the country is benefitting.

Even though the Specific Factor Model does attempt to explain the different effects of trade on different groups within a country, it does not fully account for wage distribution. There are, however, other, more comprehensive, theories, which are still based on the same principles, and that provide a more detailed analysis of the impact of international economic relations on income inequality within a country.

2.2.2 The Hecksher-Ohlin-Samuelson (HOS) Theorem – theoretical link between trade and wage inequality

According to Baldwin (2008), in 1941, Stolper and Samuelson built on the previously published works of Hecksher and Ohlin on trade theory and created what is now referred to as the Hecksher-Ohlin-Samuelson theorem (*HOS*).

As described in Baldwin (2008) and other International Economics textbooks like Krugman *et al.* (2011), Hecksher and Ohlin assumed, when they built this theorem in the 1930s, a two-country, two-good and two-factor model in which both countries have a similar level of technology (which, we argue, can be seen as concordant with reality even today, given the increasing dissemination of information and communication technologies around the globe). It is also assumed that each country has relative abundance in one production factor. Trade in goods is the only way through which a

country becomes internationally integrated, given that, in this model, production factors cannot move between countries.

An additional assumption in the Hecksher-Ohlin-Samuelson theorem is that, according to, *e.g.*, Baldwin (2008), in autarky both countries produce two goods and use both factors. If they engage in trading, however, circumstances will change, with each country specializing in the good which uses more intensively the factor that is relatively more abundant in that country.

According to Baldwin (2008), the contribution of Stolper and Samuelson to this theorem was to take the results by Hecksher and Ohlin on product specialization (namely, that each country would export the good intensive in the factor relatively more abundant in that country while importing the other good) to conclude, additionally, on the impacts such specialization would logically have on factor prices. They theorized that specialization would cause relative demand for each production factor to move in opposite ways in the two countries: in the North, the demand for skilled labor would rise while the demand for unskilled labor would fall; in contrast and symmetrically, in the South, demand for unskilled labor would rise and demand for skilled labor would fall. Accordingly, this leads to a corresponding rise in the price of the relatively more abundant factor and a decrease in the price of the less abundant factor.

The argument is, therefore, that international trade affects the relative price of these factors in different ways in the two countries. It is straightforward to interpret these two factors as being skilled and unskilled labor and the two countries as standing in for the North and South regions of the globe, with the North being relatively abundant in skilled labor, while the South is endowed with relatively more unskilled labor. Therefore, if the South is unskilled labor-abundant, trade will make it specialize in the unskilled-labor-intensive good and export it to the North. The North will in turn specialize in the skilled-labor-intensive good because it is relatively more abundant in skilled labor.

As a result, the Hechsher-Ohlin-Samuelson Theorem predicts that trade will cause the wages of skilled workers to rise in the North and fall in the South while the wages of unskilled workers are expected to rise in the South and fall in the North, leading to

higher wage inequality in the Northern (developed) countries and lower wage inequality in the Southern (developing) ones.

2.2.3 Feenstra and Hanson (FH) Theorem – theoretical link between FDI and wage inequality

Feenstra and Hanson (1997) argue, however, that analyzing only the trade of final goods (as assessed by trade openness) is not enough to account for the effects of globalization on wage inequality. As there is a global value chain that slices the production of final goods into several parts and distributes them across different parts of the globe, it is necessary to analyze the effects of offshoring, measured as Foreign Direct Investment (FDI), specifically the one flowing from the North to the South (in their paper, the countries referred to are the United States and Mexico). In their proposed model, it is the Northern country that offshores a portion of its production to the South. This portion of the production captures mostly the skilled workers in the South, thereby shifting demand from unskilled labor to skilled labor in the South, where it is, presumably and usually, cheaper. However, in the North, this portion substitutes mostly for the production of unskilled workers, which results in a similar shift: demand for unskilled labor will fall in the North. This has the effect of increasing wage inequality in both countries: in the South, by increasing the price of skilled labor, while having no effect on that of unskilled labor; in the North, by decreasing the price of unskilled labor while not affecting that of skilled labor.

2.2.4 Tang and Wood Theory – the effects of co-operation costs on wage inequality

Tang and Wood, for their part, take co-operation costs, *i.e.*, the "cost of moving know-how around the world" (Wood, 2002; p. 55) into account. This know-how "contributes to production partly by increasing the quantity of output, but mainly by improving its quality" (Wood, 2002; p. 55), *e.g.*, improving factor productivity.

According to Wood (2002), the Tang and Wood theory assumes that the workers who have this ability (know-how) and who can transmit it to others are all located in the

North (these are called "*K*-workers", while all the other workers fall under the denomination of "*L*-workers"). The authors posit that it is cheaper for this transfer of knowledge to happen in the North, because having *K*-workers working in the South involves co-operation costs (the main ones being the extra time spent on work and travel, as well as air fares and hotel bills, though the latter are deemed less significant). Therefore, in order for this transfer to happen in the South, the *L*-workers in the South (skilled and unskilled) would have to be paid less. According to Wood (2002), the authors also conclude that Northern *L*-workers have higher salaries than Southern *L*-workers, because of their proximity and easy access to *K*-workers, which leads to the relatively higher productivity of their work.

In this theory, according to Wood (2002), when co-operation costs fall, as they do with "improvements in travel and communications facilities" (Wood, 2002; p. 56), this will result in: i) increased wages for the *K*-workers because they will be in a position to work with more *L*-workers, as it becomes easier for their involvement to be profitable to Southern companies (their access to Southern production is now easier); ii) increased wages for the Southern *L*-workers, since the scarcity of *K*-work in the South is a factor contributing to their lower wages; and iii) decreased wages for the Northern *L*-workers, since there will exist relative scarcity of *K*-workers in the North (compared to the situation before the shift) and their privileged access to know-how is a factor positively contributing to their relatively higher wages. Accordingly, a reduction in co-operation costs, increases wage disparities in the North (developed countries), while it reduces wage disparities across both Southern and Northern countries for the *L*-workers.

2.2.5 Skill-Biased Technological Change (SBTC) and wage inequalities

The evolution of technology has been a constant presence in human history. The turning point of technological evolution as we see and think of it today was the Industrial Revolution, which introduced heretofore unknown equipment and machinery, as well as production techniques which rendered human intervention less crucial or which replaced it completely.

Also associated with a growing skill premium, *SBTC* "occurs when technical progress increases the total relative demand for skill of the economy (…) for given prices of skilled labour, *H*, and unskilled labour, *L*." (Chusseau *et al.*, 2008; p. 412)

According to Chusseau et al. (2008), SBTC is usually related to Information and Communication Technologies, which, as we know, have been the fulcrum of technological change since the 1980s. New information technologies are considered to be "more compatible" with high-skilled labor (at least during the adoption phase) and, therefore, in order to make full use of them, the economy must demand relatively more skilled workers. Barlevy and Tsiddon (2006), in their modeling of earnings inequality, not only consider trend inequality to be mainly influenced by technological change, but also state that there are always workers who are quicker to absorb these new technologies and who become more productive more quickly, citing this as the reason why *SBTC* is a factor in increasing wage inequality. Indeed. Mamoon and Murshed (2013) state that "trade flows bring in new technologies and ideas that enhance the productivity of all workers, but especially that of skilled workers," (Mamoon and Murshed, 2013; p. 574) the logical conclusion being that it will bring about a rise of the skill premium.

There are two possible mechanisms through which *SBTC* can act: it can be factor-biased or sector-biased. If it is factor-biased, according to Chusseau *et al.* (2008), *SBTC* appears as a change in the productivity of each factor (the factors here are skilled and unskilled labor), leading to a higher relative productivity of skilled labor. In the case of a sector bias, Chusseau *et al.* (2008) refer technological change as having no impact on the production function itself (*i.e.*, there is no change in the relative productivity of the factors at the firm-level) but, instead, state that this change is felt more keenly in some sectors than in others. In this case, and according to Chusseau et al. (2008), the effects of technological change are assumed to be felt more strongly in those industries which are more skill-intensive, rather that unskill-intensive." Such *SBTC* generates higher factor productivity for skilled labor, not at the individual-firm level, but at the economy level. They go on to say that, whichever of these aspects is at work, the end result is normally one of these two: a higher skill premium or unemployment among unskilled labor. *SBTC* is, then, another mechanism through which wage inequality between skilled and unskilled workers may increase.

It is true that it is not as directly linked to globalization as the other mechanisms we have presented are, but we know that ICTs are one of the features that make globalization possible: ICTs make the world more connected and globalization is the channel which makes technology changes spread quickly across many countries and have the above-mentioned effects on the recipient economies.

Moreover, it is important to note that this mechanism is not completely independent of the others. Even when economists point to SBTC, rather than trade, as the main cause of growing inequality, the relationship between the two cannot be neglected. Indeed, Krugman *et al.* (2011) mention recent research which has concluded that trade contributes indirectly to the increase in inequality associated with *SBTC* "by accelerating this process of technological change" (Krugman *et al.*, 2011; p. 96): the reasoning is that firms with more contact with international realities have easier access to new technologies. It is even shown by some studies, according to Krugman (2008), that when firms begin to export, they also upgrade to production techniques which rely more on skilled workers.

Mamoon and Murshed (2013) expand on the relationship between trade and SBTC by arguing that international trade leads to technology transfer "(processes like learning by doing)" (Mamoon and Murshed, 2013; p. 590) which not only links HOS and SBTC together but also emphasizes why a mechanism like SBTC cannot be left out of a study such as ours. Goldberg and Pavnick (2007) go so far as to term it "trade-induced skill-biased technological change" (Goldberg and Pavnick, 2007; p. 52).

The effect of the breaking down of the value chain and the subsequent redistribution of the different portions throughout different countries is also important: Krugman *et al.* (2011) refer the NAFTA agreement as an opportunity for the United States companies to offshore their low-skilled tasks to countries like Mexico, while keeping the high-skilled ones in the US, thereby increasing relative wage for high-skilled workers at home.

2.2.6 Other Mechanisms

The mechanisms described above are those most commonly addressed in the literature attempting to assess how globalization may affect the wage gap. Much of the recent

literature is concerned with the effects of globalization as a whole, so it makes sense for these mechanisms to be tested together: for example, trade in final goods and services does not account for all the facets of economic integration between countries in this increasingly globalization age (Chusseau *et al.*, 2008).

However, several other mechanisms link globalization with inequality.

Andersen and Sørensen (2011), for instance, make a distinction between the effects of increased international trade on different firms, by separating them into two sectors: the exporting (tradable) sector and the non-tradable one, with no direct contact with foreign markets. In their model, product market integration squeezes protection rents by making market entry easier for foreign firms. This also affects income inequality across workers: lower profitability in the non-tradable sector leads to lower wages. Instead, in the export sector, workers receive some of the additional benefit from lower trade frictions: firms' profits are higher and, therefore wages increase.

For his part, Gourdon (2011) argues that it is not only North-South trade which widens wage inequality in developing countries, but also the recent growth in South-South trade, itself a consequence of globalization and increased trade between nations. The author presents the richer Southern countries ("middle-income countries") as the "North" amid developing countries, therefore presenting the mechanism through which wage inequality develops in these countries as just a transposition of Hecksher-Ohlin theory: because these countries are now "the developed countries" in the equation, the *HOS* mechanism will work to widen wage inequality within them. Gourdon also refers to sector-biased *SBTC* as a possible factor in widening inequality within Southern countries. He argues that, while North-South trade leads to higher competition and productivity in low-skill-intensive industries, South-South trade does the same in medium-skill (MSL) and high-skill (HSL) industries, thereby increasing wage inequality within Southern countries.

Betrán and Pons (2013) refer, in addition to widening trade and *SBTC*, "institutional factors" such as the decline in the role of education, the supply of skilled labor and the erosion of labor market institutions, related to a loss of power on behalf of trade unions and a reduction in the minimum wage, this wage having been designed to protect low-wage workers and their earnings, as causes for widening wage inequality. As per Betrán

and Pons (2013), low-skilled workers were historically more involved in unions and the main concerns of labor unions were labor conditions and wages. Therefore, it follows that a weakened influence of these institutions would pave the way for higher wage inequality between skilled and unskilled workers. As for education, namely government-provided education, it is the only way of transmitting knowledge in need for a future (or present) worker to update skills which could lead them to a higher-paid job. The authors consider that "the more schooling in appropriate contents the population received, the easier it was to work in skilled and higher paid jobs," (Betrán and Pons, 2013; p. 151) which might reduce wage inequality between skilled and unskilled workers by increasing the supply of skilled workers, and would definitely decrease inequality in a more general sense, by having workers who would otherwise be working in low-paid jobs have the opportunity to do more qualified work.

According to Betrán and Pons (2013) arguments, globalization is not necessarily linked to weakened social protection (in the form of weaker labor market institutions, such as minimum wage or other labor-related standards). They state that, during what they refer to as "the first globalisation period" (1870-1913) we did not observe a reduction in these standards, going even further in arguing that they were created in the first place "to protect lower-paid workers when there was an increase in trade and globalization" (Betrán and Pons, 2013; p. 150). In the current period of globalization, however, these institutions (ie. education and labor) no longer work as they did in the past in developed countries and there is no longer a concern for compensating workers for the increase in wage inequality brought on by globalization.

However, while it is true that these standards are a more a result of political decisions than a direct result from more international trade, it is also true that the pressure to enact fiscal policies that are more attractive to companies would not exist in a less globalized world, where each company would have to comply to the policies of its own country's government.

Furthermore, according to Bertola (2008), while early inequality was mainly related with different capital and land endowments, recent changes in inequality are more related to labor incomes, and the education is more and more relevant when it comes to which opportunities workers have and how much they earn. (We can also conclude that the conditions one has at birth are relevant as well. On the one hand, wages are not the

only relevant variable to measure inequality, but they are an increasingly more important one, since, for instance, initial endowments are now less important than before. On the other hand, however, institutional factors prove to be key influences. Lack of investment in education and the decreasing power of labor unions provide less of a chance for social mobility, which would unambiguously decrease wage inequality.

2.3 Literature on empirical evidence

Betrán and Pons (2013) argue that, even though globalization is not a recent phenomenon, it is not exactly the same now as it was in the 19th and early 20th centuries. Early-periods of globalization focused on "mass migration to the New World" (Betrán and Pons, 2013; p. 147) while the contemporary process is more focused on "trade and foreign direct investment" (Betrán and Pons, 2013; p. 147).

There are several different mechanisms working to enhance or offset each other when it comes to wage inequality, especially in what concerns the link between globalization and inequality. The theoretical mechanisms described above all speak of an effect of globalization (in its many forms) on wage inequality, but they don't predict the same results, especially when it comes to comparing developed and developing countries. It is then up to empirical works to validate these theories and to show how they can be applied to real, complex economies.

It is worth mentioning that, in many studies, wage inequality is frequently identified with more general inequality measures, such as gross income or disposable income inequality, given that wage is the main source of personal income for most of the people. However, a word of caution is in order: disposable income is net of taxes and transfers from the government and thus, the redistributive policy is likely to be non-neutral for the assessment of inequality. Analysis of how globalization affects such measures of income inequality must control for redistributive policies.

2.3.1 Testing the HOS Theorem

This framework has mostly been used to compare countries with each other (Dreher and Gaston, 2008; Elmawazini *et al*., 2013), as well as to analyze regions within countries, more often the US states (Chordokrak and Chintrakarn, 2011) and Chinese regions (Han *et al.*, 2012), although some studies for single countries, *e.g.*, Italy (Matano and Naticchioni, 2010), are also found in the literature. In most studies, however, the main focus is not how trade affects countries in relation to each other ("North" *vs.* "South"), but rather on how trade has affected one or a set of countries unilaterally (*i.e.*, belonging either to "North" or "South"). For example, Han *et al.* (2012) test the role of the rising levels of international trade in China, a "labor-abundant developing country", and conclude that they have increased inequality.

Empirical tests of the *HOS* theorem have not given unambiguous, consensual, results. While the predicted effect on developed countries (a raise in the skill premium) exhibits significant empirical support (Dreher and Gaston, 2008; Matano and Naticchioni, 2010; Chordokrak and Chintakram, 2011), there is also a vast part of the literature which argues that the wage gap, and therefore, inequality, has been on the rise in developing countries and that international trade is one of the more (if not the most) important factors (, Gourdon, 2011; Han *et al.*, 2012; Elmawazini *et al.*, 2013).

Goldberg and Pavnick (2007), a widely cited study, found that in the 7 developing countries it examined (all of which are known for having gone through a major trade policy reshaping between the 1970s and the 1990s) skill premium and, in most cases, consequently, wider wage inequality increased. They warn against linking these two facts too quickly, reminding us it's necessary to take other factors into account, yet present quite clearly a non-validation of the HOS theorem.

Meschi and Vivarelli (2009) conclude that aggregate trade flows have no impact on wage inequality in developing countries, yet when they disaggregate these flows according to their origin and destination (because they believe trade with higher-income is the one likely to spread new technology and know-how, therefore, to be the one that is truly skill-biased, resulting in a higher skill premium.), they find that when lower-income countries trade with middle-income countries, it does lead to higher income inequality in the former. Trade between lower-income countries leads instead to lower

income inequality. These results do not validate the mechanism, for if we consider lower-income countries to be the "Southern" developing countries and middle-income countries to be "the North" in this dichotomy, trade between them should lead to lower inequality in the lower-income countries.

Similarly, Gourdon (2011) concludes that, for developing countries, trade with other developing countries is even more conducive to an increase in wage inequality than trade with developed countries: "*an increase of 1% in the share of south trade relative to north trade increases inter- industry wage inequality by 0.027%*" (Gourdon, 2011; p. 369). His analysis rests on much the same principles as Meschi and Vivarelli's (2009) (within "Southern" countries, middle-income is the North, low-income is the South), yet it does not reach the same conclusion: South-South trade is more penalizing for middle-income countries, as predicted by the transposition of the HOS mechanism that has been implied.

Khalifa (2014) reaches much the same conclusion, going so far as to prove there is a "skill-abundance threshold", above which a country's skill premium is increased by trade with countries with lower skill. The logic and conclusions are not very different from the papers discussed in the two above paragraphs, for it is assumed that what distinguishes middle-income and lower-income countries (as well as North and South in the original theory) is their relative skill abundance.

Other works focusing on OECD countries, however, (for instance OECD (2011)), suggest that trade has no significant role in affecting wage inequality. Krugman's (2008) review of empirical literature on how US trade with developing countries had affected the country's skill premium also shows a modest effect.

Table 2.1 summarizes some of the most important studies focusing on the effects of international trade on several inequality measures. The table details the validation (or not) of the *HOS* theorem, describes the sample and the estimation method of the study. From the results presented in Table 2.1 we can conclude that empirical results of the HOS theorem are decidedly mixed

Table 2.1 - Testing the HOS mechanism

Authors	Sample Countries	Sample Period	Wage inequality measure	Methodology	Validation	Non-validation
Goldberg and Pavnick (2007)	**7 developing countries** Mexico, Colombia, Argentina, Brazil, Chile, India, Hong Kong	21 country-decade observations: 1970s 1980s 1990s	wage gap between skilled and unskilled workers 90–10 log wage differential Gini of log wages GINI index	No Regression		x
Bertola (2008)	**14 countries** Estonia, Ireland, Italy, Japan, Mexico, Netherlands, Norway, Portugal, Romania, Spain, Switzerland, Turkey, United Kingdom, United States	Irregular observations between 1970 and 2000 Yearly data	GINI Index	OLS regressions		x (The author finds no significant correlation between trade and inequality)
Dreher and Gaston (2008)	**100 countries:** 24 OECD countries 76 Non-OECD countries	1970-2000 Averages over five years	Theil index of Industrial Pay Inequality Household income inequality	GMM	x (for OECD countries)	(No robust impact found on inequality for developing countries)
Meschi and Vivarelli (2009)	65 developing countries	1980-1999 Yearly data	Estimated Household Income Inequality Index	LSDVC estimation		x (trade with industrialized nations worsen inequality)

Matano and Naticchioni (2010)	Italy	1991-2002 Yearly data	Gini index Log of Average Wage Ratio of Skilled to Unskilled	OLS Random Effects	x	
Chordokrak and Chintrakarn (2011)	**48** US States	1988-2003 Yearly Data	top 1% income share top 10% income share Gini coefficient relative mean deviation (RMD) Atkinson index Theil index of Industrial Pay Inequality	OLS Fixed Effects		x (lack of statistically significant data)
Gourdon (2011)	67 developing countries	1976–2000 Yearly data	Standard deviation of the logarithm of wage by industry Theil index	OLS GMM	x	
Han *et al.* (2012)	**6** Chinese regions	1988–2008 Yearly Data	wage gap between percentiles (10^{th} and 90^{th}, 50^{th} and 90^{th}, 10^{th} and 50^{th})	Fixed Effects		x (trade contributes to higher inequality)

Munshi (2012)	**Bangladesh**	plants in five manufacturing industries 28 time series observations covering the 1975–2002 period	real wages of skilled and unskilled workers	OLS Fixed Effects 2SLS	x (author finds trade lowers inequality)	
Elmawazini *et al.*(2013)	**8** South-East Europe and CIS countries	1992-2007 Yearly data	GINI Index	LSDV Method Parks (1967) method		x (trade makes inequality rise in transition economies)
Khalifa (2014)	25 developing countries	1980-2000 Yearly data	Theil index of Industrial Pay Inequality	OLS white-correlated SEs	x	

2.3.2 Testing the FH Theorem

This mechanism and ensuing predictions find a strong support in recent empirical literature on the effects of globalization on wage inequality. Indeed, FDI is widely regarded as being a very significant part of the economic dimension of globalization, establishing interactions between developed and developing countries. Several studies find a positive relation between the rise of FDI outflow levels in developed countries and rising inequality (OECD, 2011) while others report a link between growing FDI inflow levels and rising inequality in developing countries (Chen *et al.,* 2011; Figini and Görg, 2011), even as they credit FDI with fostering economic growth in these countries.

Choi (2006) finds that FDI has the effect of raising inequality in all the 119 (developed and developing) analyzed countries, with a special emphasis given to outward FDI, which turned out to have a more pronounced effect on income equality.

In his analysis of South-South relations and of their impact on inequality in developing countries, Gourdon (2011) also concludes that increasing flows of FDI do tend to

increase wage inequality, since FDI mainly occurs in more skill-intensive sectors. This seems to be a concern only in "upper-middle income countries", *i.e.*, in the richer Southern countries, "*where FDI is more important and where skilled labor is more present*" (Gourdon, 2011; p. 369).

Figini and Görg (2011), however, also find that inward FDI has the effect of decreasing wage inequality in developed countries. This does not necessarily go against the *FH* theory, since the effects of inward FDI on developed countries are not predicted by the theory. Chordokrak and Chintrakarn (2011), however, find that, in the US, inward FDI contributes to a rise in wage inequality.

Similarly, Çelik and Basdas (2010) find that FDI inflows contribute to greater equality both in developed and developing countries. However, when they analyze the Asian "miracle countries", they find that inequality rises along with these inflows.

Table 2.2 summarizes the most important studies focusing on the effects of FDI on several inequality measures. The table details the validation (or not) of the *FH* theorem, describes the sample and the estimation method of the study.

Table 2.2 - Testing the FH mechanism

Authors	Sample Countries	Sample Period	Wage inequality measure	Methodology	Validation	Non-validation
Choi (2006)	**119** countries	1993 to 2002 Yearly data	Gini index	Pooled OLS	x	
Çelik and Basdas (2010)	**5** developed countries **5** developing countries **6** miracle countries	1995-2007 Yearly data	Gini coefficient	Fully Modified OLS		x
Chen *et al.* (2011)	China	1998-2007 Yearly Data	log of the average wage level in each enterprise in each year	OLS Fixed Effects	x	
Chordokrak and Chintrakarn (2011)	**48** US States	1988-2003 Yearly Data	top 1% income share top 10% income share Gini coefficient relative mean deviation Atkinson index Theil's entropy index	OLS Fixed Effects	x	
Figini and Görg (2011)	**103 countries:** **34** OECD countries	1980-2002 Yearly data	Gini index Theil index	GMM		x

	69 Non-OECD countries					
Gourdon (2011)	**67** developing countries	1976–2000 Yearly data	standard deviation of the logarithm of wage by industry Theil index		GMM	x
OECD (2011)	**34** OECD countries	1975-2010	(Regression not available.)			x
Tomohara and Yokota (2011)	Thailand	1999-2003 Yearly data	share of skilled labour's wages in an establishment's total wage bill wages of skilled and unskilled workers	Fixed Effects	x	
Elmawazini *et al.*(2013)	**8** South-East Europe and CIS countries	1992-2007 Yearly data	GINI Index	Least Squares Method and Parks (1967) method	x	
Franco and Gerussi (2013)	**17** Transition Economies	1990-2006 Yearly data	Gini index	Fixed Effects LSDVC		x
Rivera and Castro (2013)	**13** Latin America countries	Depending on the country, the data period varies from 1978 to 2000	wages of skilled and unskilled workers	OLS	x	

2.3.3 Testing the Skill-Biased Technological Change Theory

Chusseau *et al.* (2008) have done an extensive literature review of empirical studies trying to conclude whether North-South trade or *SBTC* are the main factors in growing wage inequality. They conclude that, from initial studies trying to isolate one "guilty party" of growing inequality, both theoretical and empirical literature have evolved towards more complex frameworks and that it is not possible to completely extricate the effects of these mechanisms from one another: they are both conducive to higher wage inequality within countries.

Gourdon (2011) proves that when technological change is geared towards unskilled-labor intensive sectors, "*it decreases wage inequality across industries, for all groups of countries, although it is not significant for upper-middle income countries*" (Gourdon, 2011; p. 370). The issue then happens when technological change is skill-biased, as the title suggests, it is not necessarily a problem of technological advancement in itself.

Almeida and Afonso (2010), from a sample of 25 OECD countries, analyze the relative influence of *SBTC* and International Trade (IT) on the increasing wage premium. Even though its relative importance depends on which wage inequality measure the authors use (the effect of *SBTC* is felt more keenly when the authors use the wage ratio of college graduates to lower-secondary graduates as opposed to the ratio of earnings of college graduates to upper-secondary graduates), *SBTC* is always a key factor in increasing wage inequality, especially in developed countries.

Esposito and Stehrer (2008), in their analysis of "transitional economies" (economies in the process of switching from central-planning to a capitalist economic system) namely the Czech Republic, Hungary and Poland, conclude that "*the concentration of SBTC in skill intensive industries explains part of the rise in the skill premium*" (Esposito and Stehrer, 2008; p. 363) in these countries, validating the importance of *SBTC* in wage inequality.

Mamoon and Murshed (2013)'s study argues that, while an initial greater stock of skilled labor causes trade openness to have the effect of diminishing equality in developing countries, after trade liberalization higher education levels accrued might lead to higher inequality. They suggest that developing countries should invest in

primary and secondary education, and not focus only on higher education, since this would bridge the skill gap and lead to greater equality.

Haskel and Slughter (2002)'s results state that it's sector-biased SBTC, rather than factor-biased SBTC which has a more pronounced effect on skill premia: when the technological change takes place in skill-intensive sectors, the skill premium rises, and conversely when it takes place in unskilled-intensive sectors, it falls.

Table 2.3 summarizes the analysis above, providing additional details on different inequality measures, on the methodology as well as on the sample covered by the study.

Table 2.3 – Testing the Skill-Biased Technological Change Mechanism

Authors	**Sample Countries**	**Sample Period**	**Wage inequality measure**	**Methodology**	**Validation**	**Non-validation**
Haskel and Slaughter (2002)	10 OECD countries	1970s 1980s	Percent changes in manufacturing-wide average annual non-production earnings relative to the average annual production earnings	Weighted least squares method	x	
Chussseau *et al.* (2008)	The paper itself is a literature review.				x	
Esposito and Stehrer (2008)	Three European transitional economies (Czech Republic, Hungary, Poland)	1995-2003	ratio of wage in more skill-intensive industries to the wage less skill-intensive industries	Pooled OLS	x	
Almeida and Afonso (2010)	25 OECD countries	1997-2006	ratio of earnings of college graduates to	Fixed Effects Model Random	x (*SBTC* is the main explanation	

			upper-secondary graduates wage ratio of college graduates to lower-secondary graduates	Moments Model	for an increase in wage premium in developed countries)	
Gourdon (2011)	67 developing countries	1976–2000	standard deviation of the logarithm of wage by industry Theil index	OLS GMM	x	
Mamoon and Murshed (2013)	108 developing countries	latest value available for the Theil index for every country in the 1990s	Theil index	OLS IV	x	

2.3.4 Testing the Tang-Wood Theory

Anderson (2006) has tested this mechanism and has been able to validate it in some way, by offering empirical evidence of the fact that developing countries with lower cooperation costs tend to have higher wages.

However, extensive empirical testing of this mechanism does not seem to exist.

As we can see, economic literature is not unanimous on the impacts of globalization on inequality, even as it takes the overall benefits of globalization as a given. The relationship between globalization and wage inequality is a multi-faceted one, as the variety of mechanisms described above can attest. We propose to test these mechanisms ourselves using the methodology detailed in the next section.

3. Methodology and Data

3.1 The samples

Our sample is comprised of the 28 countries that were member-states of the European Union (EU) as of 2014. It is our contention that we can, within the universe of the European Union, distinguish between countries which are the intra-EU equivalent to "North" and "South" countries, since these definitions are intrinsically comparative.

The "South" sample is comprised of the EU-countries with average (2000-2011) GDP *per capita* (PPP constant 2011) below 30 thousand international dollars (data in Table A.1, in Annex A, taken from the World Bank databank[1]), or that joined the European Union from 2004 onwards. This group of countries includes: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovak Republic and Slovenia.

The "North" countries are the remaining countries: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Spain, Sweden and the United Kingdom.

As regards time dimension, we use data covering the period between 1970 and 2007. Smaller time-horizons are defined, due to data restrictions, when testing the HOS and SBTC mechanisms (1993-2007 and 1982-2007, respectively).

3.2 The model

We propose a general panel data model, using these two samples and covering for the period detailed above. The model general specification can be represented as follows (Gujarati, 2004; page 656):

$$\boldsymbol{T}_{it} = \boldsymbol{C}_i + \boldsymbol{\delta}_t + \boldsymbol{\beta X}_{it} + \boldsymbol{u}_{it}\,, \qquad \textbf{(3.1)}$$

[1] World Bank databank accessed at http://databank.worldbank.org/data/home.aspx, on April 2014

with *t = 1971, ..., 2007*, and applied to two samples of countries, the 13 "North" countries and the 15 "South" countries, both detailed above (subscript *i*).

The dependent variable, ***T***, is the ***Theil index*** of industrial wage inequality, widely used in the related empirical literature, extracted from a database put together by the University of Texas Inequality Project and based on United Nations Industrial Development Organization (UNIDO) data. We chose this variable instead of the also widely used Gini index because it focuses on actual earned income, instead of overall disposable income and a wage inequality measure seems to be more adequate to test the alternative theoretical predictions outlined in the previous chapter.

The Theil's t-statistic (***T***) of industrial pay inequality is computed as:

$$\boldsymbol{T = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{x_i}{\bar{x}} \cdot ln\frac{x_i}{\bar{x}}\right)}, \qquad \textbf{(3.2)}$$

where $\boldsymbol{x_i}$ is the income of each individual *i*, $\boldsymbol{\bar{x}}$ is the average income of the group, and ***N*** is the total number of individuals. As ***T*** is a measure of entropy, the index measures the disorder in a system: therefore, equality is at its peak when Theil = 0. The higher the index is, the higher the inequality within whichever population is under scrutiny.

Matrix ***X*** includes the independent variables, while ***u*** is the vector of error terms. Independent variables are used with a period lag since it is reasonable to expect that impacts on inequality are not of a contemporaneous nature.

We use several independent variables related to the alternative dimensions of globalization. ***Trade Openness*** is our chosen measure of international trade, which we use to test the **HOS mechanism**; it is defined as the sum of exports and imports of goods and services in percentage of the country's gross domestic product (GDP). ***FDI inflows*** and ***FDI outflows*** (in percentage of GDP) are used to test the **FH mechanism**. Finally, the percentage of ***High Tech Exports*** in total manufactured exports and the percentage of ***GERD*** **(Gross Expenditure in Research and Development over GDP)** are chosen proxies to capture whether the country is technologically advanced (thus testing the **SBTC mechanism**). ***High-tech exports*** are defined as exports of products with high R&D intensity (like computers, scientific instruments, etc.) and ***Expenditure***

on Research and Development refers to how much is currently being spent (including both public and private expense) on developing the country's production processes, as a proxy of the technological level of a country, which is presumably a result of how much is being spent to develop it.

We also control for other aspects of globalization using broader measures of globalization. In particular, we use the aggregate ***KOF Globalization Index***, a composite index measuring globalization, which includes, besides economic, social and political aspects of globalization. Specifically, the index is divided into three sections (A, B and C), which include variables related to the different aspects of globalization. Section A is concerned with the Economic aspects of globalization and includes A.1 - Actual Flows (*i.e.*, Trade, Foreign Direct Investment, Portfolio Investment and Income Payments to Foreign Nationals) and A.2 – Restrictions (*i.e.*, Hidden Import Barriers, Mean Tariff Rate, Taxes on International Trade and Capital Account Restrictions) Sections B and C are concerned, respectively, with Social and Political aspects of the phenomenon. More detailed information can be found in Table B.1, Annex B.

Moreover, we want to control for several explanatory variables. Trade ***Union Density*** is used to measure the degree to which labor institutions at work within each country affect wage inequality. Unions are expected to reduce wage inequality, as described by Betrán and Pons (2013), and as referred in the previous chapter. ***Rate of*** Lower ***Secondary Education Completion*** is used as a measure of the stock of human capital. We use secondary education completion levels and not those of higher education, because "there is some evidence that secondary education is more important in alleviating wage inequality than higher levels of education" (Mamoon and Murshed, 2013; p. 577). Finally, in order to capture the level of development, we control for the ***lnGDP*** per capita, as used for instance by Milanovic and Squire (2007) and Afonso *et al.* (2008.)

Table 3.1 provides the reader with a summary of the data sources used. The period intervals describe the earliest and latest year for which we have data. There are some gaps, especially in the "South" sample. As for the GERD variable, the process through which we decided to use two sources was the following: we first checked the World Bank databank and realized it only had data from 1996 onwards. Upon checking the OECD database, we realized it had more data but only for the "North" countries. Since

the numbers from 1996 onwards matched exactly between the two databases, we decided to use the OECD data to make sure we could cover more years in the "North" regressions.

Table 3.1 Data Sources

Variable	Period	Source
Theil	1970-2007	TIP-UNIDO database[2]
Trade Openness	1970-2007	World Bank databank[3]
FDI Inflows	1970-2007	United Nations Conference on Trade and Development[4]
FDI Outflows	1970-2007	United Nations Conference on Trade and Development[5]
High Tech Exports	1988-2007	World Bank databank[6]
GERD	"North": 1981-2007 "South": 1996-2007	OECD database[7] World Bank databank[8]
KOF Globalization Index	1970-2007	Swiss Federal Institute of Technology[9]
lnGDP	1970-2007	Computed from World Bank databank[10] data
Secondary Education Completion	1992-2007	Eurostat[11]
Union Density	1970-2007	ICWTTS[12]

[2] Database accessed at http://utip.gov.utexas.edu/ on April 2014.
[3] World Bank databank accessed at http://databank.worldbank.org/data/home.aspx, on April 2014
[4] UNCTAD database accessed at http://unctad.org/en/pages/Statistics.aspx, on April 2014
[5] UNCTAD database accessed at http://unctad.org/en/pages/Statistics.aspx, on April 2014
[6] World Bank databank accessed at http://databank.worldbank.org/data/home.aspx, on April 2014
[7] OECD database accessed at http://oecd-ilibrary.org, on April 2014
[8] World Bank databank accessed at http://databank.worldbank.org/data/home.aspx, on April 2014
[9] The Swiss Federal Institute of Technology accessed at http://globalization.kof.ethz.ch/,on April 2014.
[10] World Bank databank accessed at http://databank.worldbank.org/data/home.aspx, on April 2014
[11] Eurostat database accessed at http//ec.europa.eu/Eurostat, on May 2014.
[12] ICWTTS database accesed at http://www.uva-aias.net/208, on April 2014

3.3 Choosing between Fixed and Random Effects

Since both samples are comprised solely of European Union countries, and therefore are not taken from a random sample, we conjecture that the general form is a fixed-effects model rather than a random-effects model. Quoting Gujarati (2004), "[i]f it is assumed that ε_i and the X's are *uncorrelated*, REM [Random Effects Model] may be appropriate, whereas if ε_i and the X's are *correlated*, FEM [Fixed Effects Model] may be appropriate." (Gujarati, 2004; p. 650). He goes on to explain the error term ε_i might be correlated in the case of a sample in which the aspects included in the error term (*i.e.*, things that are relevant but not in the regressions. Thus, $\boldsymbol{C}_i$ (our ε_i) and $\boldsymbol{\delta}_t$ are vectors that include constant terms capturing, respectively, cross-section and period fixed effects. In order to confirm our conjecture, we decided to run the Hausman test; as an example, results are shown in Table 3.2 for the case of the equation testing the All Effects regression.

Table 3.2 - Hausman test for the All Effects regression

	"North"			***"South"***		
	Chi-Sq. Statistic	*Chi-Sq. d.f.*	*Prob.*	*Chi-Sq. Statistic*	*Chi-Sq. d.f.*	*Prob.*
Cross-section random	131.135261	8	0.0000	21.731477	8	0.0054

The results on the Hausman test, in Table 3.2, point towards a rejection of the null hypothesis (which would lead us to a random-effects model). Although reported results apply to the regression testing all the mechanisms together (see regression in Table 4.14, in chapter 4, below), similar results were robust for the other regressions. Therefore, we will, as conjectured, decide for a fixed-effects model to assess the effects of globalization on wage inequality, using both samples.

In addition, we performed the Redundant Fixed Effects tests as to assess the presence of either cross-section or period fixed effects or both; detailed results are shown below, in

Table 3.3, also for the case of the regression which includes all mechanisms (see regression in Table 4.14, in chapter 4, below).

Table 3.3 - Test for cross-section and period fixed effects for the All Effects regression

	"North"			***"South"***		
Redundant Fixed Effects	*Statistic*	*d.f.*	*Prob.*	*Statistic*	*d.f.*	*Prob.*
Cross-section F	47.149318	(12,205)	0.0000	15.803030	(12,63)	0.0000
Cross-section Chi-square	332.426495	12	0.0000	130.548744	12	0.0000
Period F	0.996445	(25,205)	0.4735	0.550114	(10,63)	0.8476
Period F Chi-square	28.785393	25	0.2730	7.869271	10	0.6416
Cross-section/Period F	16.227127	(37,205)	0.0000	9.255068	(22,63)	0.0000
Cross-section/Period Chi-square	343.451750	37	0.0000	135.609836	22	0.0000

As we can see from the results in Table 3.3 above, cross-sections fixed effects are found in both these samples, with *p-values* for both samples being well below 10%. Period fixed effects are clearly rejected. Cross-section/period fixed effects are also significant but we can assume these are derived from the results on cross-section effects. Since the presence of cross-section effects is robust, and given the comparability of results between samples and the better underlying overall adjustment, we estimate the model considering solely cross-section fixed effects.

3.4 Expected effects of globalization on the Theil Index

Table 3.4, below, shows the expected effects of each of the globalization-related variables on the ***Theil Index***, according to the theories we reviewed above.

Table 3.4 Theory-based expected effects of globalization on the Theil Index

Variable	Trade Openness	FDI Inflows	FDI Outflows	High Tech Exports	Expenditure on R&D
Tested Mechanism	HOS	FH		SBTC	
Expected Effect on Theil Index ("North" countries)	(+)	•	(+)	(+)	(+)
Expected Effect on Theil Index ("South" countries)	(-)	(+)	•	(+)	(+)

Most of these variables, in theory, are positively correlated to inequality. Therefore, we are expecting a positive signal on all instances, except when it comes to the influence of trade in the Southern sample.

4. Analysis of Results

4.1. Overview of wage inequality and trade patterns in the EU

Inequality Trends in the European Union

Before analyzing the results, we will begin with a brief look at the trends for the chosen inequality variable – ***Theil index*** of industrial pay inequality. Since we have available data, we analyze the (percent) change in the ***Theil index*** for the period from 1970 to 2007, as well as the (percent) change for the ten-year sub-periods. Table 4.1 and Table 4.2 report the results for the "North" and "South" subsamples, respectively.[13]

Table 4.1 - Theil Index Evolution - "North"

	1970-1980	1980-1990	1990-2000	2000-2007	1970-2007
Austria	-12%	**22%**	**11%**	-19%	-3%
Belgium	**39%**	-12%	-4%	**26%**	**49%**
Denmark	**9%**	**8%**	**36%**	**4%**	**68%**
Finland	-28%	-7%	**2%**	**40%**	-4%
France	-3%[1]	-7%	**37%**	-9%	**12%**
Germany	-10%	-1%	**2%**[2]	-	-10%[4]
Ireland	**4%**	**22%**	-53%	**25%**	-26%
Italy	-70%	**23%**	**68%**	-16%	-47%
Luxembourg	-20%	**29%**	-29%	**120%**	**62%**
Netherlands	-50%	**33%**	**10%**	**7%**[3]	-22%[5]
Spain	-55%	**41%**	**15%**	-36%	-53%
Sweden	-36%	**-1%**	**29%**	-	-18%[6]
United Kingdom	-7%	**42%**	**17%**	-27%	**13%**

Notes: (1) Values in bold represent increases in wage inequality.

(2) In some cases, data was not available for all years. Check superscript: 1. 1977-1979; 2. 1990-1992; 3. 2000-2005; 4.1970-1992; 5. 1970-2005; 1970-2000

(3) Source: University of Texas Inequality Project – based on UNIDO data.

The literature seems to take as granted the fact that inequality is growing. For the "North" sample, the most obvious rising trend in the inequality numbers occurred

[13] In our panel analysis, below, we will not be able to use such a long span due to data restrictions on the other variables.

during the 80s, with the 90s also being a strong decade for rising inequality. Overall, between 1970 and 2007, only five countries (Belgium, Denmark, France, Luxembourg and the United Kingdom) out of our sample of 13 had a rise in inequality but, as we can see, the fluctuations in-between these years were numerous and affected all countries of the sample.

We can also conclude, however, with the help of the descriptive statistics present in Annex C, that the difference between minimum and maximum values is not very large (0.042).

Table 4.2 - Theil Index Evolution - "South"

	1970-1980	1980-1990	1990-2000	2000-2007	1970-2007
Bulgaria	**48%**	-29%	**1223%**	-7%	**1183%**
Croatia	-	**164%**[2]	**14%**	-1%	**197%**[13]
Cyprus	-7%	-27%	-45%	-42%	-79%
Czech Republic	-	-25%[3]	**375%**	-22%	**176%**[14]
Estonia	-	-	-	-7%	-7%[15]
Greece	**29%**	-4%	-15%[6]	-13%[11]	**23%**
Hungary	-53%	**202%**	**183%**	**39%**	**459%**
Latvia	-	-	-73%[7]	**1%**	-72%[16]
Lithuania	-	-	**262%**[8]	-30%	**152%**[17]
Malta	-43%	**8%**	**160%**	**48%**	**136%**
Poland	**10%**	**45%**	**201%**	0%	**379%**
Portugal	**22%**[1]	**43%**[4]	-2%[9]	-14%[12]	**87%**[18]
Romania	-	-	**906%**	-1%	**894%**[19]
Slovak Republic	-	-	**71%**[10]	**16%**	**98%**[20]
Slovenia	-	**189%**[5]	**55%**	**62%**	**625%**[21]

Notes: (1) Values in bold represent increase in wage inequality.

(2) In some cases, data was not available for all years. Check superscript: 1. 1973-1980; 2. 1986-1990; 3. 1987-1990; 4. 1980-1987; 5. 1987-1990; 6. 1990-1998; 7. 1993-2000; 8. 1992-2000; 9. 1994-2000; 10. 1991-2000; 11. 2003-2007; 12. 2005-2007; 13. 1986-2007; 14. 1987-2007; 15. 2000-2007; 16. 1993-2007; 17. 1992-2007; 18. 1973-2007; 19. 1990-2007; 20. 1991-2007; 21. 1987-2007

(3) Source: University of Texas Inequality Project – based on UNIDO data.

In the "South" sample, we were presented with more gaps in the data. However, we can see that inequality rises substantially by more than in the "North" sample. Between 1970 and 2007, only Cyprus displays a falling trend in inequality. In Bulgaria, the rise between 1970 and 2007 has been of over 1,000%, with many of the other countries also

exhibiting rises of over 100%. The difference between maximum and minimum values is also noticeably higher than in the "North" sample, roughly of 0.071.

As for the standard deviation, the value in the "South" sample is more than the double of that observed for the "North" sample (0.015526 *vs*. 0.007082).

As we can see, the countries in the "South" sample clearly exhibit a very different pattern from the ones in the "North" sample. This motivates us to study them separately.

Main Trading Partners

We did a cursory analysis of the weight of intra-EU trade for these countries. It is widely known that the European Union (EU) countries trade mostly with EU counterparts. If that is the case for our sample, this motivates an assessment of the HOS mechanism within the EU countries.

Table 4.3 - Main Trading Partners - "North"

	% of Intra-EU in Total Exports	% of intra-EU in Total Imports
Austria	74%	80%
Belgium	76%	71%
Denmark	69%	72%
Finland	59%	66%
France	64%	69%
Germany	64%	65%
Ireland	63%	67%
Italy	61%	60%
Luxembourg	88%	78%
The Netherlands	80%	51%
Spain	72%	65%
Sweden	59%	70%
United Kingdom	58%	53%
Average	**68%**	**67%**

Notes: (1) Average between 1999 and 2011.

(2) Source: Eurostat.

Table 4.4 - Main Trading Partners - "South"

	% of Intra-EU in Total Exports	% of intra-EU in Total Imports
Bulgaria	61%	58%
Croatia	63%	66%
Cyprus	65%	66%
Czech Republic	86%	77%
Estonia	76%	74%
Greece	62%	59%
Hungary	82%	68%
Latvia	74%	76%
Lithuania	66%	59%
Malta	46%	71%
Poland	80%	72%
Portugal	79%	77%
Romania	73%	69%
Slovakia	88%	74%
Slovenia	78%	79%
Average	**72%**	**70%**

Notes: (1) Average between 1999 and 2011.

(2) Source: Eurostat.

As we can see in Tables 4.3 and 4.4, the weight of intra-EU trade is obvious and present in both samples, although the averages are slightly higher in the "South" sample.

In an attempt to analyze whether these weights have changed with EU membership, we considered, for the "South" sample, pre- and post-European Union periods for a more detailed analysis (Table 4.5).

Table 4.5 - Main Trading Partners - "South" (pre- and post-EU integration)

	% of Intra-EU in Total Exports		% of Intra-EU in Total Imports	
	Pre-EU	**Post-EU**	**Pre-EU**	**Post-EU**
Bulgaria	62%	61%	59%	58%
Croatia	-	-	-	-
Cyprus	69%	59%	70%	59%
Czech Republic	86%	87%	78%	74%
Estonia	71%	84%	77%	69%
Greece	-	-	-	-
Hungary	80%	85%	69%	67%
Latvia	71%	79%	76%	76%
Lithuania	64%	71%	61%	57%
Malta	45%	46%	74%	66%
Poland	79%	82%	73%	70%
Portugal	-	-	-	-
Romania	72%	74%	72%	66%
Slovakia	86%	90%	75%	73%
Slovenia	77%	79%	78%	81%
Average	71%	74%	72%	68%

Notes: (1) Average between 1999 and year of entry into the EU, then between year of entry and 2011.

(2) Source: Eurostat.

Interestingly, while the weight of intra-EU exports in total exports rose for these countries after they joined the EU, the weight of intra-EU trade in total imports has decreased.

4.2. Testing the HOS mechanism

We attempted to test the **HOS mechanism** by first running the regression using the data for the two samples separately (see results in Table 4.6). Since we have data restrictions, time horizon covers the period from 1993 to 2007.

Table 4.6 - HOS mechanism

	"North"	*"South"*
Trade Openness (-1)	*** 0.006675* *(2.136902)*	*0.005796* *(1.128539)*
Rate of Secondary Education Completion (-1)	*** 0.024144* *(2.098978)*	** -0.070628* *(-2.726026)*
lnGDP (-1)	*-0.003748* *(-0.831207)*	*-0.007056* *(-0.962291)*
KOF B (-1)	** 0.000345* *(3.715705)*	*-9.66E-05* *(-0.450457)*
KOF C (-1)	*** 0.019274* *(2.121034)*	*5.71E-05* *(0.412475)*
No. of Countries	12	15
Adjusted R-squared	0.844348	0.865888
F-statistic	48.46517	46.19535
Prob (F-statistic)	0.000000	0.000000

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

The model exhibits a high value for the adjusted *R-squared*, of over 80%, which indicates a high goodness-of-fit of our model. Also, the very low probability value attached to the *F-statistic* confirms that the estimated relation between our independent and depend variables is, overall, significant.

As mentioned in the previous sections, from our inspection, lagged variables deliver more significance than non-lagged variables, suggesting that the effect of these variables on inequality happens with some delay. This is why we used lagged explanatory variables in this, and most, regressions.

We did not use the Trade Union Density control variable because it exhibits a correlation of over 60% with the ***lnGDP*** variable in the case of the "North" sample (see Table C.3 in Annex C). This correlation does not exist in the "South" sample but we decided to preserve the same regressors in both samples.

We find that trade is only statistically significant in the "North" sample. In this case, it is significant at 5%. It exhibits a positive coefficient, consistent with the expected results of Hecksher-Ohlin theory, at least concerning higher-income countries. However, ***Trade Openness*** is not statistically different from zero for the "South" sample. Thus, trade does not affect negatively inequality in the "South" countries, as predicted by the HOS theorem.

Moreover, we applied the same model to the whole sample, including a dummy variable to differentiate between "North" and "South" countries (D = 1 if "South" country). Regression is run including both ***X*** and ***X*D*** as regressors. The results are shown in Table 4.7:

Table 4.7 - HOS mechanism (with dummy variable)

	Both samples	***"South" (additional effect)***
Trade Openness (-1)	*** 0.007781* *(2.119852)*	*-0.001985* *(-0.334770)*
Rate of Secondary Education Completion (-1)	**** 0.022134* *(1.787853)*	** -0.092761* *-3.253050*
lnGDP (-1)	*0.006554* *(1.315597)*	*-0.013610* *(-1.544288)*
KOF B (-1)	*-7.27E-05* *(-0.648666)*	*-2.38E-05* *(-0.099204)*
KOF C (-1)	** -0.000523* *(-2.737605)*	** 0.000580* *(2.465792)*
No. of Countries	27	
No. of Observations	275	
Adjusted R-squared	0.905451	
F-statistic	73.88763	
Prob (F-statistic)	0.000000	

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

The results of the regression presented in Table 4.7 generally confirm those of Table 4.6 for the "North" sample. For the entire sample, ***Trade Openness*** is statistically

significant and has a positive coefficient, lending support to HOS theorem. "South" (for which D=1) does not exhibit significant different results from average. This helps make our understanding more complete, as it suggests that the variables interact in the same way for the "South" sample, *i.e.*, that trade would also have a positive coefficient also in this case.

4.3. Testing the FH mechanism

Table 4.8 shows the estimation testing for the validity of the FH mechanism, using two separate samples: "North" and "South". Given data availability, the time-horizon covers now from 1971 to 2007.

Table 4.8 - FH Mechanism

	"North"	***"South"***
FDI Inflows (-1)	**** -0.004518* *(-1.688980)*	*0.001011* *(0.077812)*
FDI Outflows (-1)	*0.001709* *(0.363017)*	** -0.142045* *(-2.735529)*
Union Density (-1)	*-0.002721* *(-1.138774)*	*** -0.023186* *(-2.358218)*
KOF B (-1)	** 0.003047* *(2.062695)*	*** 0.000270* *(2.307672)*
KOF C (-1)	** 0.005395* *(2.398646)*	*0.000144* *(1.308143)*
No. of Countries	13	13
No. of Observations	363	146
Adjusted R-squared	0.868778	0.799528
F-statistic	141.9818	35.01727
Prob (F-statistic)	0.000000	0.000000

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

Both regressions exhibit a high value of adjusted *R-squared* (over 80% for the "North" sample and almost 80% for "South"), indicating a high goodness-of-fit for our model. The *p-value* of the *F-statistic* is 0 in both cases, which tells us that the regression is significant overall.

In this case, we used the ***Union Density*** control variable and therefore could not use ***lnGDP*** because they exhibit high correlation in the "North" sample see (Table C.3 in Annex C) and the use of the former produces a better overall adjustment. We did not use the Rate of Secondary Completion as the regression works better without it, *i.e.*, there is an improvement in the significance of the relevant independent variables without it.

In order to test the Feenstra-Hanson mechanism, we used both the inflows and outflows of Foreign Direct Investment, as detailed previously. In the "North" sample, only the ***FDI Inflows*** are statistically significant: ***FDI Inflows*** have a negative coefficient meaning that they reduce wage inequality. Our result of the impacts of FDI on inequality in developed countries does not confirm the predicted by the theory since it assumes the "North" countries will be the ones investing; *i.e.*, theory predicts, instead, that ***FDI Outflows*** will (negatively) affect wage inequality. According to our results, ***FDI outflows*** in the "North" countries have no impact on inequality.

As for the "South" sample, the results are symmetrical. ***FDI Inflows*** are non-significant while ***FDI Outflows*** are highly significant (1%) and exhibit a negative coefficient: when the level of ***FDI Outflows*** rises, wage inequality decreases.

These results are tricky because they are not aligned with the theory: the FH mechanism predicts a positive coefficient for ***FDI Outflows*** in developed countries and a negative coefficient for ***FDI Inflows*** in developing countries. All we can say is that Foreign Direct Investment does have an effect on within-country inequality in the European Union, even though we cannot conclude for the relations predicted by the FH theorem.

Nevertheless, the study by Figini and Görg (2011) exhibits results similar to ours: they also found that growing inward FDI contributed to lower wage inequality in developed countries.

Similarly, as with the HOS mechanism, we test the FH mechanism using the whole sample, but also including as regressors the product of a dummy variable (=1 for the

"South" countries) with the original variables. In this case, both ***lnGDP*** and Trade ***Union Density*** can be used as regressors since correlation is low (see Table C.5 in Annex C). The results are detailed in Table 4.9:

Table 4.9 - FH Mechanism (with dummy variable)

	Both samples	***"South" (additional effect)***
FDI Inflows (-1)	*-0.003160* *(-1.474722)*	*0.004330* *(0.352639)*
FDI Outflows (-1)	**** 0.009924* *(1.903848)*	** -0.122637* *(-2.632643)*
lnGDP (-1)	** -0.008509* *(-4.985451)*	*0.003240* *(0.355762)*
Union Density (-1)	*-0.003192* *(-1.506506)*	*** -0.030059* *(-2.245729)*
KOF B (-1)	** 0.000140* *(5.978497)*	*-2.90E-05* *(-0.216369)*
KOF C (-1)	*** 0.000118* *(2.577466)*	*0.000112* *(0.792496)*
No. of Countries	26	
No. of Observations	503	
Adjusted R-squared	0.884936	
F-statistic	105.3457	
Prob (F-statistic)	0.000000	

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

The regression displays a high level of *adjusted R-squared*, at almost 90%, and its *F-statistic* probability equals zero: our model has a high goodness-of-fit and the regression is significant.

The results of the regression including the "South" dummy are not entirely concordant with our previous results, in what concerns the "North" sample since ***FDI inflows*** are shown not to be statistically significant.

FDI outflows, on the other hand, are statistically significant on average and have a positive coefficient (in accordance to FH theory for developed countries), but are shown to have a negative coefficient for the "South" sample: they contradict their overall effect on the sample and lower inequality in the "South"; the latter results lend robustness to those shown in Table 4.8, above, for the "South" sample.

4.4. Testing the SBTC mechanism

In Table 4.10 we report the results for the test of the **SBTC mechanism** using the two separate samples and considering the share of ***High Tech Exports*** on overall manufactures exports as the relevant explanatory variable. Period data refers to 1993-2007.

Table 4.10 - SBTC Mechanism

	"North"	***"South"***
High Tech Exports	**** -0.015942* *(-1.769203)*	*-0.017073* *(-1.641096)*
lnGDP (-1)	**** -0.006347* *(-1.666036)*	*-0.004586* *(-0.679597)*
Rate of Secondary Completion (-1)	*** 0.024587* *(2.082222)*	** -0.073174* *(-2.924495)*
KOF B (-1)	** 0.000464* *(4.716347)*	*-8.69E-05* *(-0.412935)*
KOF C (-1)	** 0.000226* *(3.331300)*	*7.39E-05* *(0.519641)*
No. of Countries	12	15
No. of Observations	137	134
Adjusted R-squared	0.852245	0.866380
F-statistic	50.02764	46.38747
Prob (F-statistic)	0.000000	0.000000

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

Overall, the regression is statistically significant, with a high *adjusted R-squared*, of over 85%. This indicates a high goodness-of-fit of our model, as has been the case for our regressions thus far. Equally, the probability of the *F-statistic* is zero, indicating a significant relation between our dependent variable and all independent variables.

The percentage of ***High Tech Exports*** over GDP is statistically significant in the "North", exhibiting a negative coefficient. Therefore, in the "North", technological change seems to have a negative effect on inequality, suggesting that, perhaps in this case, it does *not* work, as the theory states, skill-biased. Could it be that a higher level of investment in high-tech industries is benefitting the lower-skilled, lower-wage workers as much as, or indeed more than, highly-skilled workers?

In order to achieve a more robust result, we estimated, as before, the same equation using the whole sample and including, additionally, the cross products of a dummy (D=1 for the "South" countries) with all the remaining regressors. Results are presented below in table 4.11:

Table 4.11 - SBTC mechanism (with dummy variable)

	Both samples	***"South" (additional effect)***
High Tech Exports	*-0.007352* *(-0.785818)*	*-0.009721* *(-0.697635)*
lnGDP (-1)	*0.004990* *(0.971211)*	*-0.009576* *(-1.134376)*
Rate of Secondary Completion (-1)	**** 0.024739* *(1.812170)*	** -0.097913* *(-3.454852)*
KOF B (-1)	*3.28E-05* *(0.273902)*	*-0.000120* *(-0.497133)*
KOF C (-1)	**** -0.000419* *(-1.958056)*	**** 0.000493* *(1.922991)*
No. of Countries	27	
No. of Observations	271	
Adjusted R-squared	0.905064	
F-statistic	72.50038	
Prob (F-statistic)	0.000000	

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

The results in this regression do not show the variable ***High Tech Exports*** to be statistically significant for the average sample; this may be because of the non-significance in the "South" sample found in the previous table.

In Table 4.12, we test the SBTC mechanism using an alternative variable for technology-enhanced production: the gross expenditure on research and development (GERD). Time horizon covers 1982-2007.

Table 4.12 - SBTC mechanism (GERD)

	"North"	***"South"***
Gross Expenditure on Research and Development (-1)	****0.000698* *(1.679838)*	*0.000142* *(0.031117)*
lnGDP	**-0.008371* *(-5.071339)*	*0.002890* *(0.416872)*
KOF B (-1)	**0.000199* *(5.961419)*	*-8.52E-05* *(-0.365294)*
KOF C (-1)	**4.90E-05* *(1.716381)*	*0.000190* *(1.407856)*
No. of Countries	13	15
No. of Observations	267	142
Adjusted R-squared	0.849686	0.841544
F-statistic	94.97688	42.60205
Prob (F-statistic)	0.000000	0.000000

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

As before, the model exhibits a good adjustment with the regressors being statistically significant as a whole.

We did not use the ***Rate of Secondary Education Completion*** as it exhibits a high correlation with our explanatory variable in the "North" (-0.75 in Table C.3 in Annex C). ***lnGDP*** worked better in this particular regression, which is why we used it.

GERD is significant only for the "North" (at 10% confidence). It exhibits a positive coefficient, meaning that a higher level of gross expenditure on research and development makes wage inequality to rise in these countries. This is in accordance to the theory, which says that technological progress is skill-biased and will therefore create higher demand for skilled workers, raising the skill wage-premium.

For the "South" sample, our results show that technology appears to be neutral for the relative demand of skilled *vs*. unskilled workers.

As with the previous regressions, we assess the effect of GERD in wage inequality considering the whole sample, with a dummy identifying the "South" countries. We show the results in table 4.13

Table 4.13 - SBTC mechanism (GERD) (with dummy variable)

	Both samples	***"South" (additional effect)***
Gross Expenditure on Research and Development (-1)	*0.000359* *(0.851697)*	*-0.000218* *(-0.048772)*
lnGDP	** -0.008527* *(-5.772888)*	**** 0.011417* *(1.650851)*
KOF B (-1)	** 0.000178* *(6.072852)*	*-0.000263* *(-1.148240)*
KOF C (-1)	*** 0.000113* *(2.062490)*	*7.70E-05* *(0.540493)*
No. of Countries	28	
No. of Observations	409	
Adjusted R-squared	0.905882	
F-statistic	113.1991	
Prob (F-statistic)	0.000000	

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

Using this method, the GERD variable does not appear to be significant, possibly because of non-significance for the "South" sample as recorded before.

4.5. Testing all mechanisms

In order to achieve more robust results, we also test all mechanisms using the same regression. We tested both samples separately, as well as together with a dummy variable, and used both ***High Tech Exports*** and ***GERD*** as SBTC relevant variables. We present the results in tables 4.14 through 4.17.

Table 4.14 - All Effects (with *High Tech Exports*)

	"North"	***"South"***
Trade Openness (-1)	*0.000113* *(0.044303)*	** 0.022746* *(4.037305)*
FDI Inflows (-1)	**** -0.006685* *(-1.957685)*	*0.007885* *(0.703472)*
FDI Outflows (-1)	*-0.002998* *(-0.606800)*	** -0.129298* *(-2.643481)*
High Tech Exports (-1)	**** 0.010906* *(1.859956)*	*0.004778* *(0.219671)*
LnGDP (-1)	** -0.011119* *(-6.750797)*	**** -0.010055* *(-2.355079)*
KOF B (-1)	** 0.000219* *(3.708790)*	*** 0.000211* *(1.974399)*
KOF C (-1)	** 7.15E-05* *(1.837760)*	** 0.000254* *(3.417030)*
No. of Countries	13	15
No. of Observations	188	200
Adjusted R-squared	0.926365	0.794808
F-statistic	124.8184	37.70593
Prob (F-statistic)	0.000000	0.000000

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

These regressions also exhibit high *adjusted R-squared* values, as well as very low *F-statistic* probabilities, indicating that the regressions, thus the relation between the variables, are significant.

Generally, the results confirm the results we got from the previous regressions. However, ***Trade Openness*** is not found to be significant in this regression for the "North" sample, but it is significant for the "South" sample with a positive coefficient. From our previous results, the one closest to this one is in table 4.7 (in the dummy variable regression) where trade is statistically significant for both samples and a

different result is not found for the South sample, indicating that, for "South", it should also have a positive coefficient.

The FDI results confirm what we found in both previous regressions as well: ***FDI inflows*** are found to be significantly negative for the "North" sample, while ***FDI outflows*** are significant and have a negative coefficient in the "South" sample.

The results for ***High Tech Exports***, however, are not in line with the previous results. Here, for the "North" sample, the variable displays a positive coefficient, unlike in the regressions in Tables 4.10 and 4.11. In the "South," the variable is found to be non-significant.

Table 4.15 - All Effects (with GERD)

	"North"	***"South"***
Trade Openness (-1)	*** 0.003775* *(2.135412)*	**** 0.012064* *(1.910978)*
FDI Inflows (-1)	** -0.006780* *(-2.909496)*	*-0.002510* *(-0.198470)*
FDI Outflows (-1)	*0.000808* *(0.172516)*	**** -0.076907* *(-1.977)*
GERD (-1)	*** 0.000948* *(2.532222)*	*0.002328* *(-0.351086)*
lnGDP (-1)	** -0.008875* *(-4.678346)*	*** -0.004898* *(-0.627158)*
KOF B (-1)	** 0.000197* *(5.359720)*	*3.29E-05* *(0.145752)*
KOF C (-1)	*4.35E-05* *(1.405201)*	** 0.000253* *(1.784780)*
No. of Countries	*13*	*15*
No. of Observations	*251*	*142*
Adjusted R-squared	*0.881785*	*0.846346*
F-statistic	*99.14698*	*37.98306*
Prob (F-statistic)	*0.000000*	*0.000000*

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

The regressions exhibit a high *adjusted R-squared* as well as a low *F-statistic* probability: the regression is significant.

Trade is found significant and with a positive coefficient for both samples, once again unlike our previous results, in which it was found significant for the "North" sample. The results for FDI are also consistent with all the results we had so far. GERD displays a positive coefficient for the "North" sample and is not significant in the "South", confirming our results in the first GERD regressions (Table 4.9).

We did not use Secondary Education Completion Rate as it was too correlated with the GERD variable. We did not use it above so as to make the results comparable.

Table 4.16 – All Effects (with dummy variable and *High Tech Exports*)

	Both samples	***"South" (additional effects)***
Trade Openness (-1)	*4.83E-05* *(0.017317)*	** 0.022697* *(3.613757)*
FDI Inflows (-1)	**** -0.006865* *(-1.908423)*	*0.014750* *(1.254141)*
FDI Outflows (-1)	*-0.003383* *(-0.655372)*	*** -0.125915* *(-2.562601)*
High Tech Exports (-1)	** 0.019793* *(3.016435)*	*-0.015015* *(-0.661570)*
lnGDP(-1)	** -0.008602* *(-5.179191)*	*-0.001453* *(-0.233432)*
KOF B (-1)	*** 0.000107* *(2.327411)*	*0.000103* *(0.887926)*
KOF C (-1)	*1.05E-05* *(0.249673)*	** 0.000244* *(2.857428)*
No. of Countries	28	
No. of Observations	388	
Adjusted R-squared	0.867902	
F-statistic	63.01543	

Prob (F-statistic)	0.000000

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

Table 4.17 – All Effects (with dummy variable and GERD)

	Both samples	***"South" (additional effects)***
Trade Openness (-1)	*** 0.003900* *(1.963572)*	*0.008164* *(1.264911)*
FDI Inflows (-1)	*** -0.005548* *(-2.339149)*	*0.003037* *(0.242441)*
FDI Outflows (-1)	*0.004882* *(0.895033)*	*** -0.081789* *(-2.139481)*
Gross Expenditure in Research in Development (-1)	*0.000365* *(0.776259)*	*0.001963* *(0.435774)*
lnGDP(-1)	** -0.008233* *(-4.112575)*	*0.003335* *(0.424444)*
KOF B (-1)	** 0.000156* *(4.468251)*	*-0.000123* *(-0.550993)*
KOF C (-1)	**** 9.81E-05* *(1.657911)*	*0.000155* *(1.034017)*
No. of Countries	28	
No. of Observations	393	
Adjusted R-squared	0.911820	
F-statistic	99.86468	
Prob (F-statistic)	0.000000	

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

In both the tables above, we find confirmation for some of our previous results, though not all. ***Trade Openness*** has a positive estimated coefficient confirming HOS for developed countries on average; however this result seems to hold only when GERD is taken as relevant SBTC variable. When ***High Tech Exports*** is used, it is found to be significant and positive for the "South" sample.

We conjecture that the use, in the same regression, of both ***Trade Openness*** and ***High Tech Exports*** may make the latter capture the effects of the former. ***FDI inflows*** have a negative coefficient for the "North", while ***FDI Outflows*** have a negative coefficient for the "South". Technological variables seem to have little impact; the non-significance of ***GERD*** in the "South" may affect both sample average as non-significant as well.

Table 4.18 – All Effects (with KOF Index)

	"North"	***"South"***
KOF A (-1)	*3.54E-05* *(1.294480)*	** 0.000278* *(2.914902)*
High Tech Exports (-1)	*-0.002728* *(-0.466614)*	*0.024571* *(1.143560)*
lnGDP(-1)	** -0.011546* *(-5.981325)*	*** -0.013864* *(-2.567748)*
KOF B (-1)	** 0.000238* *(3.392314)*	*7.66E-05* *(0.655486)*
KOF C (-1)	*6.59E-05* *(1.606805)*	** 0.000262* *(3.175404)*
No. of Countries	13	15
No. of Observations	195	200
Adjusted R-squared	0.867191	0.787150
F-statistic	75.51412	39.73315
Prob (F-statistic)	0.000000	0.000000

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

We also tried a regression in which we tested all mechanisms but did so by using the economic aspects of the KOF globalization index as a stand-in for the trade and FDI variables (***KOF A***, as explained in chapter 2 and Annex B.1,) simply in order to determine whether Trade or FDI flows weigh more in the final result in affecting wage inequality: since trade has had a positive coefficient in all our regressions and FDI flows hold negative coefficients for the samples for which they are significant (FDI inflows for the "North" sample and FDI outflows for the "South" sample), it would seem to follow that, if KOF A had a positive coefficient, the effect of trade is stronger in the final result and, if it had a negative coefficient, it is FDI the one with the most pronounced influence in inequality.

As we can see in Table 4.18 above, ***KOF A*** is found to be non-significant for the "North" sample, but it exhibits a positive value for the "South" sample, indicating trade has a stronger effect on inequality in these countries.

The values for *adjusted R-squared* are above 80% and the probability of the *F-statistic* still equals zero for this regression, as in the previous ones.

Table 4.19 – All Effects (with dummy variable and KOF index)

	Both samples	***"South" (additional effects)***
KOF A (-1)	** 0.000157* *(3.670239)*	*-8.58E-05* *(-1.323063)*
High Tech Exports (-1)	*-0.009524* *(-1.232299)*	*0.014866* *(1.565883)*
lnGDP(-1)	** -0.001997* *(-2.908064)*	** 0.002414* *(3.050070)*
KOF B (-1)	*0.000111* *(1.045243)*	** -0.000448* *(-3.412042)*
KOF C (-1)	*-8.67E-05* *(0.754758)*	** 0.000371* *(4.449285)*
No. of Countries	28	
No. of Observations	395	
Adjusted R-squared	0.486500	
F-statistic	38.32838	
Prob (F-statistic)	0.000000	

Notes: (1) Significant at 1% (*), 5% (**) and 10% (***); *t-statistics* in parenthesis.

(2) Estimations made under white-diagonal standard error correction for valid statistic inference.

Making the same test with a dummy variable gives us a similar result: KOF A is shown to have a positive coefficient, indicating trade weighs more on the final result and that the economic aspects of globalization (in this case, the increased flows of trade, FDI, etc.) have the effect of increasing inequality. This is the result for both samples on average and, possibly because of the "South" influence (in the previous regression, KOF A increases wage inequality in the "South" sample). Trade influences inequality more than FDI does, which means that, overall, the economic aspects of globalization have the effect of raising wage inequality.

4.6 Other aspects of globalization

The other aspects of globalization, political and social, consistently exhibit a positive coefficient for both samples in nearly every regression (there are few exceptions for the political aspects in the "South" sample), implying that even the aspects of globalization which are not directly related to the economy or economic performance have the effect of causing inequality to rise.

This result is more robust for the "North" sample, however, as often for the "South" the variables are non-significant.

However, we do not think these aspects are ever independent of the economic component (the spread of the McDonald's chain, for example, a staple of our globalized world, is an economic flow first – the company seeks profit, and social second – it leads to a world where there are certain things we all have in common,) so we need to be cautious to read them as separate when inequality is concerned.

4.7 Control variables across estimations

The control variables behave largely as expected and exhibit consistent results. The level of ***lnGDP*** *per capita* clearly has a negative coefficient, meaning that, as GDP *per capita* rises, inequality falls. Richer countries, then, should have lower inequality than poorer countries.

The rate of completion of secondary education is found to be significant for the "North" sample but, unlike we expected, its coefficient, when significant, is positive. It seems then that the higher this rate, the higher inequality. Does this mean that, as more and more people achieve relatively higher education levels, they leave those who have not achieved it further behind? The fact that the results for the "South" sample are opposite (when significant, the coefficient is negative) seems to indicate the level of education has different impacts in these two sets of countries: in the "South", higher education may still lead to lower inequality. We tried regressions with the rate of higher secondary and tertiary completion but they led much to the same results.

Union density, which we ended up being unable to use in most regressions, was found to be significant and to display, as expected, a negative coefficient, since unions give workers bargaining power and tend to fight for higher salaries, especially for the low-skilled workers.

5. Conclusions

At the onset of this study, we started with several goals in mind. Relying on the relevant literature, our general idea was that globalization had an effect on within-country wage inequality. Our first step then was to review the existing literature, in order to first clarify the main definitions, namely those of globalization and inequality, and then to understand how the various facets of the former may affect the latter.

We found that the mechanisms through which globalization act are manifold, from International Trade, to FDI and Technological Change (although this last one is only indirectly connected to the growing openness of countries to one another, technological change is highly augmented through globalization, as people from different countries can share their new technologies and contribute to each other's research). Additionally, international pressure to create, *e.g.*, uniform labor laws, among other common institutional frameworks, may also have an effect on within-country inequality. The mechanisms through which these different facets act are also varied and complex. Our first conclusion was, then, that there is not one single effect of globalization on inequality: there are many, and they do not all work in the same direction. For example, according to the literature, growing international trade is found to have the consequence of decreasing inequality in developing countries whereas it increases inequality in the developed ones (referred to in the literature as Heckscher–Ohlin-Samuelson theorem, HOS). However, growing inflows (outflows) of FDI are expected to increase inequality in developing (developed) countries according to the Feenstra-Hanson theorem (FH).

As such, we reviewed studies in which these theories had been submitted to empirical tests, in order assess if data supports them. As so often happens in economic literature, not all empirical results point in the same direction. Regarding many mechanisms (namely the Hecksher-Ohlin-Samuelson theorem), there have been positive and negative results regarding its support, and indeed the negative results have, in some cases, led to the reinterpretation of the theory instead of leading economists to discard it altogether. It is difficult then to conclude, on literature review alone, whether these theories hold. In particular, these mechanisms are bound to work differently depending on which country (or set of countries) we try to apply them to.

Therefore, we decided to test them ourselves. We decided to assess how these mechanisms affect a reality close to us – the European Union (EU) countries, covering annual data from 1970 to 2007. This set of countries has hardly been study in the literature testing for these mechanisms and, even though it encloses developed countries, there are striking differences between them in what regards their stage of development. Therefore, we divided the member-states of the European Union into two groups, one which would best capture the "North" as it is defined in economic literature, as the group of countries which are richer and have a larger supply of higher-skilled labor (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Spain, Sweden, United Kingdom), and the other group representing the "South" (Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Slovenia).

We chose the Theil Index of Industrial Pay Inequality as our dependent variable because we wanted to isolate the effect of these mechanisms on wages and not study how they interact with overall disposable income. In fact, the theories at stake draw implications on wage premium and not on disposable income inequality. Moreover, wages are a very relevant source of income for the vast majority of people.

Regarding the international trade mechanism, our results support, for the overall sample of the EU countries, the HOS theorem. Results appear to be rather robust for the "North" sample, whereas the effects for the "South" are rather weak: indeed, we did not find a negative relation between trade and inequality, but trade openness is not significant in affecting inequality in most of our regressions.

Results on the FDI are the most robust across regressions. Feenstra and Hanson predict the effect of *FDI* on inequality but they rely on the assumption that Northern countries will be solely the sources of ***FDI*** while the Southern countries act solely as ***FDI*** receivers; therefore their theory only applies to how developed countries react to growing ***FDI outflows*** and how developing countries react to growing ***FDI inflows***. Even if, when we consider the entire sample, FH results hold (***FDI outflows*** increase wage inequality), most of our results show that ***FDI flows*** tend to reduce inequality in both set of countries: ***FDI outflows*** are found to reduce inequality in the "South" countries whereas ***FDI inflows*** reduce wage inequality in the most developed EU countries.

We also tested the SBTC mechanism to assess how technology, usually boosted by globalization, affects wage inequality. Relying on two variables, the share of high technology exports on total exports and the gross expenditure on research and development (GERD), we conclude that whereas results are mixed in the "North" countries for the former variable, the latter consistently contributes to increasing inequality in the most developed countries. We conjecture that when technology is more mature and is successful in improving competitiveness (as increasing exports) it might benefit wage distribution; however, in the early stages of technology development (as measured by GERD), we find evidence for skill-based technology change in the "North" countries, meaning that a higher technological level increases inequality in this case.

When replacing the economic characteristics of globalization (ie. trade and FDI) with a composite index such as the KOF economic component, we conclude that it increases wage inequality on average and thus we may conjecture that the effect of trade dominates in affecting inequality relatively to those attached to FDI flows.

Moreover, testing for other non-economic aspects of globalization, as captured by the KOF index, we found rather robust results showing that globalization, at both political and social levels, causes wage inequality to increase.

Our conclusions relying on EU data confirm that the relation between globalization and wage inequality is not straightforward. Some aspects of it lead to a rising skill premium (like trade and technological progress) and others (foreign direct investment), instead, cause the skill premium to diminish.

One limitation of this work is that we failed to fully mimic globalization flows between the "North" and the "South" countries of the EU. Indeed, even still most of the trade is of intra-EU nature, we should take into account only the bilateral trade between the "North" and the "South" countries and not the overall trade of a given country. This implies that, some of the trade is intra sub-samples or that, in trading with non-EU countries, some "South" countries indeed act as "North" relative to their main partners.

The same criticism applies to FDI flows, since "South" countries are likely to receive inflows from the "North" but also act as investors, thus as "North", in non-EU

countries. This partially justifies the impact of FDI outflows in reducing inequality in the “South”.

Further refinement in data treatment in future research work is expected to make more clear the effective differences between the “North” and the “South” EU countries, lending robustness to the test of the different mechanisms operating from globalization to wage inequality.

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Annex A

Table A.1 – GDP *per capita*, PPP (constant 2011 international $)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
Luxembourg	80,39	81,44	83,89	84,26	86,70	89,87	92,81	97,41	94,98	88,06	89,15	88,85	88,15
Ireland	39,70	41,02	42,52	43,39	44,40	46,08	47,32	48,26	46,27	42,87	42,19	42,95	43,91
Denmark	40,70	40,84	40,90	40,95	41,78	42,68	43,99	44,49	43,88	41,17	41,56	41,83	42,06
Netherlands	39,22	39,68	39,45	39,40	40,14	40,87	42,19	43,75	44,36	42,52	42,94	43,15	41,47
Austria	37,72	37,90	38,35	38,50	39,25	39,92	41,18	42,54	42,96	41,18	41,79	42,89	40,35
Belgium	36,74	36,91	37,24	37,39	38,45	38,90	39,68	40,52	40,60	39,15	39,61	39,84	38,75
Sweden	34,91	35,26	36,02	36,72	38,13	39,18	40,63	41,67	41,09	38,69	40,88	41,76	38,75
Germany	35,86	36,35	36,29	36,13	36,56	36,83	38,24	39,54	40,04	38,08	39,67	40,98	37,88
Finland	32,93	33,60	34,14	34,74	36,07	36,99	38,48	40,36	40,29	36,67	37,73	38,62	36,72
France	34,13	34,50	34,57	34,63	35,26	35,63	36,26	36,86	36,62	35,29	35,72	36,26	35,48
Italy	34,67	35,29	35,40	35,22	35,60	35,76	36,43	36,86	36,19	34,05	34,53	34,63	35,39
United Kingdom	31,42	31,98	32,58	33,71	34,58	35,45	36,16	37,11	36,54	34,39	34,69	34,80	34,45
Spain	30,07	30,80	31,12	31,50	31,97	32,57	33,32	33,85	33,61	32,04	31,83	31,73	32,04
Cyprus	28,78	29,62	29,87	29,92	30,47	30,91	31,57	32,70	33,50	32,66	31,91	31,23	31,09
Greece	24,25	25,19	25,98	27,43	28,53	29,09	30,59	31,58	31,44	30,45	29,04	27,05	28,38
Malta	26,12	24,95	25,46	25,33	25,03	25,78	26,26	27,29	28,30	27,34	27,94	28,32	26,51
Slovenia	22,11	22,72	23,56	24,24	25,29	26,25	27,70	29,44	30,45	27,76	28,02	28,16	26,31
Portugal	25,06	25,37	25,43	25,10	25,43	25,58	25,90	26,47	26,43	25,63	26,12	25,83	25,69
Czech Republic	19,49	20,17	20,64	21,43	22,44	23,92	25,53	26,84	27,44	26,05	26,62	27,05	23,97
Hungary	17,74	18,44	19,32	20,12	21,14	22,02	22,91	22,97	23,22	21,68	22,00	22,41	21,16
Slovak Republic	15,34	15,90	16,64	17,44	18,33	19,55	21,18	23,40	24,72	23,47	24,43	25,13	20,46
Estonia	14,32	15,32	16,42	17,81	19,05	20,86	23,10	24,95	23,98	20,63	21,21	23,31	20,08
Croatia	15,39	15,90	16,68	17,57	18,30	19,07	20,02	21,06	21,50	20,03	19,63	20,21	18,78
Lithuania	11,94	12,85	13,84	15,38	16,70	18,30	20,05	22,28	23,17	19,98	20,67	22,41	18,13
Poland	14,29	14,46	14,68	15,26	16,08	16,67	17,72	18,93	19,90	20,25	21,01	21,75	17,58
Latvia	11,52	12,61	13,58	14,70	16,15	18,06	20,45	22,68	21,94	18,30	18,62	19,97	17,38
Romania	9,83	10,53	11,27	11,93	13,10	13,74	15,03	16,21	17,78	16,71	16,65	17,12	14,16
Bulgaria	9,19	9,76	10,41	11,05	11,85	12,68	13,57	14,74	15,76	14,99	15,15	15,52	12,89

Source: World Bank databank

Annex B

Table B.1 – Composition of the KOF Index

	Indices and Variables	Weights
A.	**Economic Globalization**	**[36%]**
	i) Actual Flows	(50%)
	Trade (percent of GDP)	(21%)
	Foreign Direct Investment, stocks (percent of GDP)	(27%)
	Portfolio Investment (percent of GDP)	(24%)
	Income Payments to Foreign Nationals (percent of GDP)	(27%)
	ii) Restrictions	(50%)
	Hidden Import Barriers	(24%)
	Mean Tariff Rate	(28%)
	Taxes on International Trade (percent of current revenue)	(26%)
	Capital Account Restrictions	(22%)
B.	**Social Globalization**	**[38%]**
	i) Data on Personal Contact	(33%)
	Telephone Traffic	(25%)
	Transfers (percent of GDP)	(4%)
	International Tourism	(26%)
	Foreign Population (percent of total population)	(21%)
	International letters (per capita)	(24%)
	ii) Data on Information Flows	(35%)
	Internet Users (per 1000 people)	(36%)
	Television (per 1000 people)	(37%)
	Trade in Newspapers (percent of GDP)	(27%)
	iii) Data on Cultural Proximity	(32%)
	Number of McDonald's Restaurants (per capita)	(45%)
	Number of Ikea (per capita)	(45%)
	Trade in books (percent of GDP)	(10%)
C.	**Political Globalization**	**[26%]**
	Embassies in Country	(25%)
	Membership in International Organizations	(28%)
	Participation in U.N. Security Council Missions	(22%)
	International Treaties	(25%)

Source: The Swiss Federal Institute of Technology

Annex C

Table C.1 - Descriptive Statistics - "North" sample

	Mean	Median	Std. Deviation	Min.	Max.	No. of Observations
Theil index	0,014222	0,013650	0,007082	0,003000	0,045000	454
Trade Openness	0,603179	0,488304	0,304747	0,176160	1,833062	465
FDI Inflows	0,024856	0,009878	0,066744	-0,550747	0,746971	440
FDI Outflows	0.028768	0.010324	0.077802	-0.042346	1.429486	445
High Tech Exports	0,181933	0,164332	0,098717	0,051073	0,478399	238
GERD	1.799544	1.833384	0.709264	0.400864	4.129996	310
lnGDP per capita	10,27798	9,993841	0,926193	9,117460	12,69527	494
Secondary Education Completion	0,391474	0,367500	0,128256	0,213000	0,72000	190
Trade Union Density	0,455365	0,452231	0,209830	0,075760	0,874420	470
KOF A	0.5975361	0.588100	0.150761	0.347000	0.925000	421
KOF B	0.5397171	0.544200	0.1786965	0.218400	0.921900	421
KOF C	0.6324330	0.641400	0.2008373	0.119500	0.941400	421

Table C.2 - *Descriptive Statistics – Sample 2 (South)*

	Mean	Median	Std. Deviation	Min.	Max.	No. of Observations
Theil index	0.023166	0.021600	0.015526	0.002800	0.073700	382
Trade	0.753967	0.721185	0.333080	0.798400	1.565062	362
FDI Inflows	0.033218	0.020401	0.042154	-0,097454	0,294167	397
FDI Outflows	0.005692	0.000598	0.012925	-0.013324	0.106411	349
High Tech Exports	0.105482	0.052037	0.141416	0.004005	0.717415	241
GERD	0.717786	0.63358	0.312124	0.218100	1.558110	163
lnGDP per capita	9,602834	9,216693	1,815076	7,150529	14,63861	403
Secondary Completion	0,366057	0,302500	0,188705	0,162000	0,807000	158
Trade Union Density	0,415097	0,360735	0,229374	0,000000	1,000000	196
KOF A	0.711683	0.721950	0.166651	0.406900	0.991600	494
KOF B	0.689790	0.727250	0.147933	0.334800	0.918000	494
KOF C	0.860922	0.923050	0.129834	0.453400	0.982600	494

Table C.3 - *Correlation between Variables ("North")*

	Trade Openness (-1)	FDI Inflows (-1)	FDI Outflows (-1)	High Tech Exports	High Tech Exports (-1)	GERD (-1)	lnGDP	lnGDP (-1)	Secondary Education Completion (-1)	Union Density (-1)	KOF A (-1)	KOF B (-1)	KOF C (-1)
Trade Openness (-1)	1	0.53101	0.27895	0.28249	0.31007	0.01490	0.08307	0.07846	-0.15500	0.17274	0.01197	0.184473	0.28489
FDI Inflows (-1)		1	0.33725	-0.00853	0.01862	0.01559	0.09646	0.09466	-0.02050	0.09666	0.23748	0.09790	0.04098
FDI Outflows (-1)			1	0.22413	0.25219	0.10816	0.10758	0.10587	-0.14308	-0.04456	0.23748	-0.03811	-0.00604
High Tech Exports				1	0.97226	0.10001	0.00949	-0.00050	-0.17949	0.07044	0.17895	-0.12493	0.41831
High Tech Exports (-1)					1	0.09544	0.01528	0.00591	-0.19583	0.04543	-0.42039	-0.08414	0.42178
GERD (-1)						1	0.46794	0.46791	-0.75111	0.51098	-0.39945	0.21839	0.31258
lnGDP							1	0.99978	-0.507600	0.67015	0.18607	0.12817	0.04237
lnGDP (-1)								1	-0.50897	0.66549	-0.21062	0.12814	0.04144
Secondary Education Completion (-1)									1	-0.38190	-0.20893	-0.22909	-0.36822
Union Density(-1)										1	0.00626	0.29045	0.21010
KOF A (-1)											1	1	-0.40194
KOF B (-1)												1	0.24988
KOF C (-1)													1

Table C.4 - *Correlation between Variables (South)*

	Trade Openness (-1)	FDI Inflows (-1)	FDI Outflows (-1)	High Tech Exports	High Tech Exports (-1)	GERD (-1)	lnGDP	lnGDP (-1)	Secondary Education Completion (-1)	Union Density (-1)	KOF A (-1)	KOF B (-1)	KOF C (-1)
Trade Openness (-1)	1	0.27623	-0.1201	0.39562	0.43515	0.33863	0.32082	0.31530	-0.39776	-0.21287	0.47865	0.15222	-0.2199
FDI Inflows (-1)		1	0.17682	0.21504	0.22970	-0.22852	-0.04662	-0.04863	-0.1184	0.07469	0.22765	0.02393	-0.13088
FDI Outflows (-1)			1	0.20513	0.19504	-0.13341	-0.02243	-0.01869	0.426001	0.13401	0.35499	0.17225	-0.05093
High Tech Exports				1	0.98545	-0.11564	0.32138	0.32468	0.347812	0.33993	-0.530121	0.31167	-0.36941
High Tech Exports (-1)					1	-0.10509	0.30185	0.30477	0.34305	0.30492	-0.52867	0.29948	-0.36714
GERD (-1)						1	0.37881	0.37842	-0.26861	-0.12193	0.04198	0.27169	0.14548
lnGDP							1	0.99988	-0.16400	-0.22347	-0.29459	0.51223	0.40764
lnGDP (-1)								1	-0.15600	-0.21685	-0.29342	0.51494	0.40795
Secondary Education Completion (-1)									1	0.26675	0.23176	-0.03408	0.0019
Union Density(-1)										1	-0.15239	-0.02445	-0.55140
KOF A (-1)											1	0.48781	-0.13325
KOF B (-1)												1	0.02651
KOF C (-1)													1

Table C.5 - *Correlation between Variables (Both Samples)*

	Trade Openness (-1)	FDI Inflows (-1)	FDI Outflows (-1)	High Tech Exports	High Tech Exports (-1)	GERD (-1)	lnGDP	lnGDP (-1)	Secondary Education Completion (-1)	Union Density (-1)	KOF A (-1)	KOF B (-1))	KOF C (-1)
Trade Openness (-1)	1	0.46921	0.07812	0.20316	0.22720	-0.14582	0.14911	0.14264	-0.26911	0.00121	0.54777	0.05476	-0.32968
FDI Inflows (-1)		1	0.26353	0.02934	0.04929	-0.06679	0.02040	0.01817	-0.05783	0.06934	0.31301	0.06461	-0.20047
FDI Outflows (-1)			1	0.28162	0.29979	0.30202	0.07867	0.08110	0.03822	0.06943	0.40939	0.37695	0.09689
High Tech Exports				1	0.98065	0.23216	0.21473	0.21523	0.12615	0.21216	0.47324	0.27245	-0.03785
High Tech Exports (-1)					1	0.23891	0.20715	0.20776	0.11910	0.19029	0.48539	0.28695	-0.02993
GERD (-1)						1	0.30870	0.31282	-0.31964	0.46785	0.22648	0.59370	0.42416
lnGDP							1	0.99983	-0.26378	0.24147	0.31841	0.38249	0.29345
lnGDP (-1)								1	-0.25791	0.24272	0.31647	0.38811	0.29846
Secondary Education Completion (-1)									1	-0.10673	0.03331	-0.23674	0.06645
Union Density (-1)										1	0.29785	0.15857	-0.06483
KOF A (-1)											1	0.48034	0.00595
KOF B (-1)												1	0.36551
KOF C (-1)													1